CHAPTER II

REVIEW OF

RELATED LITERATURE
A study of the relevant literature is essential to get a full picture of what has been done and said with regard to the problem under study. The search of literature before and after the selection of the problem developed deep understanding of the subject in which a research scholar intended to investigate and explore new areas. Recorded knowledge of the past revealed the problem and also developed understanding of various techniques available for such a study. By going through the previous studies, the investigator came to know that similar study had not been conducted before. It also developed the idea that contributed to the overall rationale and interpretation of data. These purposes can only be accomplished by a systematic and thorough study of the available literature.

"The literature in any field forms the foundation upon which all future work will be built." 49

Sallis and others 50 selected five hundred and twenty eight healthy fourth-grade children in California City as subjects, to examine the relationship between habitual physical activity and components of health-related physical fitness in children. The habitual physical activity was examined in relation to measures of five components of

health-related fitness; the mile run, skin-fold tests, pull-ups, sit-ups and the sit-and-reach test. The physical activity index was significantly associated with all the five fitness components. They concluded that active children appear to engage in a sufficient variety of activities to enhance multiple components of health related fitness.

Fitness levels of American Youth have shown a marked decline in the last decade according to recent studies. To determine whether such a tendency persisted among students entering colleges, the authors evaluated 115 male and 143 female students for performance on the following fitness-related variables:

(1) maximal oxygen consumption (estimated from Astrand Cycling protocol), (2) body composition (skin-fold techniques), (3) muscle endurance (sit-up protocol), (4) muscle strength (bench-press protocol) and (5) joint flexibility (upper and lower body protocols).

Although neither men nor women exhibited high levels of cardiorespiratory fitness, the women in the study showed higher relative levels than their male counterparts. Both groups showed excellent levels of muscle strength (compared with normative standards), but they achieved only an average standard for muscle endurance. Findings of relatively low levels of cardiovascular fitness compared with levels of muscle strength, particularly in men, seem to be a reflection of an inappropriate concentration of physical activity.\footnote{E.F. Pierce, \textit{et al.}, "Fitness Profiles of Activity Patterns of Entering College Students", \textit{Journal of American Coll. Health}, Vol. 41:2 (September 1992), pp. 59-62.}
Yoga therapy is the only way to perfect health. It strengthens and activates the natural resistance of the body and mind. In a group of forty physical education teachers, the completion of three months of yoga training produced significant improvement in general health and also evidence of decreased autonomic arousal and more of psychophysiological relaxation (heart rate and respiratory rate reaction) and improved somatic steadiness (decreased errors in the steadiness test).

Khan stated that yoga as a unique measure to maintain their fitness in an easy and better way, regarding maintenance of physical fitness among the adults had been proved positive. Moorthy reported that experiment evidence showed that yogic practices helped to improve the physical fitness significantly.

National health goals included an increase in the physical activity and physical fitness of school-age children by the year 2000. To assess current fitness levels in the

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54 K. Khan, “Maintenance of Physical Fitness Among Adults”. Paper presented in International Conference on Health, Sport and Physical Fitness (Haryana Agriculture University, Hissar, January 16-18, 1995).

State of Maine, more than 8000 public school students age five through nine, were assessed using a nationally known AAHPHERD health-related physical fitness test. Maine students were then compared with a national norm groups of (1) the one mile walk/run (Minutes: Seconds), (2) skin fold thickness (centimeters), (3) one-minute timed sit-ups (number performed correctly) and (4) the sit and reach test for flexibility (centimeters). Generally, Maine boys and girls scored higher than the norms on the sit-ups, sit and reach and one-mile walk/run; however, they had significantly larger skin fold thickness.\(^{56}\)

American physicians are now prescribing exercises for patients just as they would the drugs. Compliance with any exercise programme depended on realizing the needs and goals of the individual. The guidelines for the programme should include all of the components of health-related physical fitness. These included cardiorespiratory endurance, body composition, muscular strength and endurance, and flexibility. A programme for exercise should fit the life style of the patient and be life long prescription.\(^{57}\)


The Physical Fitness Index (PFI) determined by the Harvard Step Test (HST) is one of the most important indices which predicted the physical abilities of athletes. HST, Cooper's 12-min-run-walk test and one-mile run are good measures of cardiorespiratory fitness. In the present study, the scholar had attempted to determine the relationship between HST and one-mile run in an open field on thirty one school boys of a rural village, 14-15 years of age, who were in early puberty. The mean HST score was $90 \pm 7.07$, and one-mile running time was $443.45 \pm 29.82$ s. There is a good correlation between HST and running time ($r = 0.94$). Probable running time for one-mile may be determined from the HST score by using the regression equation: Running time in s $= 783 - 4 \times \text{HST} \pm 0.13$ (SE of estimate).\(^{58}\)

Exercise and physical conditioning of physical fitness play an important role in disease prevention. The three primary components of physical conditioning are endurance, flexibility and strength training. Like adults, adolescents can improve their aerobic fitness by doing aerobic activity with achievement of 60 % to 90% of the maximum heart rate for a minimum of 20 minutes at least three times per week. Flexibility should involve major muscle groups, using static stretching only and be

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individually tailored for different sports. Strength training is associated with strength gains in adolescents and is safe when supervised by knowledgeable adults into adulthood.\textsuperscript{59}

The American College of Sports Medicine (ACSM) recommended the use of 40\%, 60\%, 80\%, and 85\% of maximal oxygen consumption (VO2 max) as target values in developing exercise prescriptions. Further the ACSM stated that 55\%, 70\%, 85\% and 90\% of maximal heart rate (HR max) might be used as indices of these respective levels of \% VO2 max for the general population. The current study evaluated this relationship between \%HR max and \%VO2 max in apparently healthy, young adults. Eighty-one men and eighty-one women between the ages of 18 and 34 engaged in an incremental exercise test to exhaustion. Linear regressions of \%HR max and \%VO2 max were performed on each subject. From these regressions, target values of \%HR max were computed for each individual. Mean percentage of \%HR max were 63\%, 76\%, 89\% and 92\% at 40\%, 60\%, 80\%, and 85\% of VO2 max, respectively. At all these values of \% VO2 max, the values obtained for \%HR max were significantly greater (P < 0.001) than those used by ACSM.

Fitness affected these results, particularly among men. High fit men averaged 2% higher in %HR max than low fit men at any given value of %VO 2 max.⁶⁰

The combination of frequency, intensity and duration of chronic exercise has been found to be effective. In general, the lower the stimulus the lower the training effect and the greater the stimulus the greater the effect. As a result of specification of training and the need for maintaining muscular strength and endurance and flexibility of the major muscle groups, a well-rounded training programme including resistance training and flexibility exercises is recommended. Although age in itself was not a limited factor to exercise training, a more gradual approach in applying the prescription at older ages seemed prudent. It had also been shown that endurance training of fewer than 2 d/wk, at less than 50% of maximum oxygen uptake and for less than 10 min/d, was inadequate for developing and maintaining fitness for healthy adults. In the interpretation of this position statement, it must be recognized that the recommendations should be used in the context of participant's needs, goals and initial abilities. In this regard, a sliding scale as to the amount of time allotted and intensity of effort should be carefully gauged for both the cardiorespiratory and muscular strength and endurance components of the programme.

An appropriate warm-up and cool-down which would include flexibility exercises, is also recommended.⁶¹

The initial scores of kabaddi players were measured for the selected physical fitness components. After giving six weeks training on physical exercises, tests were conducted in physical fitness components, namely, endurance, flexibility, muscular strength, shoulder strength and speed. The post test scores of the subjects were compared with the pre test scores. From these findings, it was concluded that the physical exercises significantly improve the physical fitness components – flexibility and muscular strength as measured through sit and reach test, shoulder strength by pull ups test and speed by 50 meters run test.⁶²

One thousand students were selected at random as subjects and health-related fitness tests were conducted on them. The selected students were further divided at random into three groups namely, control group, physical exercises and yogic practices

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group. AAHPER health related physical fitness test was administered to find out their physical fitness levels before and after the treatment of experimental variables for eight-weeks. Analysis of covariance for interpreting the results was used. It was concluded that yogic and physical exercises groups had significantly improved the health-related physical fitness. When the yogic exercise group was compared with physical exercise group, yogic exercises group had significantly improved the health related physical fitness than the physical exercise group. And the yogic practices group had significantly decreased the body fat than the physical exercise group.63

Leshkevitch and others64 studied the influence of sequence of exercises in training undertakings in the development of physical foundations of speed, strength and endurance in young sportsmen. Three groups of boys, 12-14 years were given physical training for four times a week for three months to determine the effect of sequence of exercise. The observed changes were noted in speed, strength and endurance.


Travis and others found that exercise increase strength, endurance and mind-body coordination gradually, without the negative effects of the stress/recovery cycle.

Gharote evaluated the effect of three weeks yogic training programme recommended for yogic training in the NFC syllabus on the different fitness factors were measured by the Fleishman Battery of Fitness Tests. When the scores of different tests were converted into an overall fitness index Gharote found that three weeks of yoga training caused statistically significant positive changes in the fitness index for both males and females.

Moorthy made a comparison of the influence of selected yogic exercises and physical exercises on the minimum muscular fitness of the school children of age group six to eleven years. Kraus-Weber tests of minimum muscular fitness were used to determine the minimum muscular fitness of the school children and training was given on


eight stretching procedure as suggested by De Vries as physical exercise and yoga asanas as yogic exercises. He concluded that yogic exercises and physical exercises contributed significantly to improve the minimum muscular fitness of the children.

Sharpe and Liemohn\(^6^8\) conducted a study on low back functioning. In the study it was concluded that the sit and reach exercise was the effective mean for increasing low back functioning and trunk range of motion.

In 1980 the AAHPERD health related fitness test measured back hamstring flexibility. Eight hundred and twenty five young females were administered two trials of three tests. The measurements included the sit and reach test, passive hamstring flexibility. The correlation between the sit and reach test and total back flexibility and lower back flexibility were low. These findings indicated the sit and reach test had moderate criteria related validity when used as an assessment of hamstring flexibility in the health related fitness test.\(^6^9\)


Krishnan\textsuperscript{70} studied the effect of selected yogic practices upon the development of flexibility. This study was conducted in the subjects selected from the YMCA College of Physical Education, Madras, Tamil Nadu State. The result showed a good improvement in flexibility after training in yogic practices. In another study investigating the effects of a nine weeks yogic training programme on physically conditioned young males Gharote and Ganguly\textsuperscript{71} reported similar significant improvement in the physical fitness index derived from Fleishman Battery of basic fitness tests as a result of yogic training programme. The gain in extent flexibility was particularly highly significant in the experimental group undergoing yogic training.

Robson\textsuperscript{72} studied "the effect of yoga on flexibility and respiratory measures of vital capacity and breath hold time". His major conclusion was that both flexibility and vital capacity could be improved by yogic exercises.


Nine weeks training in yogic physical culture was helpful to improve general physical fitness level for nine cadet police who were already conditioned to physical activities as against control group of forty nine engaged only in school schedule as judged through:

(a) Fleishman basic fitness test (b) Curetons flexibility test (c) skinfolds and Harvard Step Test. The improvement was more significant in flexibility.\(^7\)

Static stretching procedures in the form of asanas were evaluated by De Vries\(^7\) for improvement of flexibility. Selected subjects were divided into two groups. One group was trained by static stretching method and the other by conventional ballistic methods of stretching for seven periods of thirty minutes each. Both the groups made statistically significant gains when measured by the Cureton's flexibility tests. However, he remarked that the static stretching method of Hathayoga seemed preferable because ballistic stretching methods had been commonly recognized as causing muscular soreness in the unconditioned person. Earlier evidence by De Varies\(^7\) presented some degree of improvement.


prevention and/or relief from muscular distress by the practice of static stretching method of Hathayoga. Bury\textsuperscript{76} has also suggested the use of yogic exercises in the prevention of accidents and injuries.

To examine exercise as a therapy for people with osteoporosis moderate physical activity improve fitness and overall quality of life and it improve bone mass, muscular strength and endurance. These recommendations were developed by the scientific Advisory Board of the Osteoporosis Society of Canada at its 1995 Consensus Conference.\textsuperscript{77}

The study described changes over two years in different physical fitness measures and the relationship between their changes and changes in physical activity. Maximal aerobic work capacity (Watt max), functional strength, muscular endurance, agility and flexibility were measured in 259 randomly selected high school boys and girls of 16.5 years of age and followed-up two years later, while they still attended school. Most physical fitness measures increased over time in boys and in girls an increase was found in arm extension strength and trunk extension endurance, but Wattmax per kg body mass


decreased. The physical fitness level in adolescents is so high that only physical activity at high relative intensity was supposed to have an effect on the fitness level.78

Study estimated the difficulty of various sit-ups test using an Item Response Theory (IRT) model and the Rash Passion counts model. Scores were obtained on eighteen sit-ups tests. The difficulty values of the test ranged from -4.02 to -3.57. Safrit79 and other concluded that most tests had good fit values.

Gregory80 found that interval training and continuous training were equally effective in developing endurance when total workload was equal. Gharote81 reported significant increase in the strength and endurance of the abdominal muscles of the females as a result of a selected routine of yogic exercises for a period of three weeks.

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Muscular endurance performance was influenced by the strength of the individual. Isotonic exercises were more effective than isometric exercises in the development of muscular endurance.

Rarick and Dorothy and others reported that agility seemed to be fundamental to skill in certain sports activities. Mohr and Haverstick found significant associations between volleying skill in volleyball and agility.

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Espenschade\textsuperscript{87} noted that both boys and girls increase in agility performance up to fourteen years of age, after which girls seem to decline while boys rapidly gain in agility performances.

Circuit training is an effective organisational form of doing physical exercises for improving all physical fitness components. Before and after training, the initial and final tests were conducted for the variables such as speed, agility, power, coordination, static balance and dynamic balance for the experimental and control groups. Circuit training was given for eight weeks for alternate days. The study showed that the skill related fitness components such as speed, agility, coordination, power, static balance and dynamic balance were significantly improved due to circuit training among college men soccer players. The maximum improvement attained at the sixth week of training.\textsuperscript{88}


In the past it was generally believed that agility was almost entirely dependent upon one's heritage; however, measurement and research revealed that it could be improved through practice, training and instruction.  

Meadows found that both isotonic and isometric exercises improved speed of movement, while Crowder reported isotonic and isometric exercises produced significant improvement in reaction time.

Swamy Kuvalayanda also made a claim that asanas, especially Salabhasana and Mayurasana are very effective in bringing about improved respiratory function by strengthening the respiratory muscles and by keeping the lung tissue elastic.

In the heart rate the gymnastic group was superior to that of yoga group and both the experimental groups were found to be significantly better than that of control group.

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93 Uma Datta, "Comparative Effect of Yoga and Gymnastic Programmes on Growth Pattern of Primary School Children", *Dissertation* (Submitted to the Jiwaji University, Gwalior, 1993).
Senthil Kumaran\textsuperscript{94} conducted a study on twenty students undergoing training in aerobic dance. He found that aerobic dance increased the cardiorespiratory endurance and did not improve the speed among the students.

The objective was to compare the twenty-four months intervention effects of a lifestyle physical activity programme with traditional structured exercise on improving physical activity, cardiorespiratory fitness and cardiovascular disease risk factors. One hundred and sixteen sedentary men and 119 women with self reported physical activity of less than 36 and 34 kcal/kg per day respectively. It was concluded that both the life style and structured activity groups had significant and comparative improvements in physical activity and cardiorespiratory fitness from baseline to twenty-four months.\textsuperscript{95}

Sharma\textsuperscript{96} conducted a programme on Ujjayi and Bhastrika for forty-five minutes in three spells in morning for three months on 150 school children affected by exposure to

\textsuperscript{94}R.Senthilkumaran, "National Seminar on fitness and Performance", Paper presented, (Alagappa University, Karaikudi, April 1994).


M.I.C. Gas. Resting pulse rate, vital capacity, blood pressure, haemoglobin percentage and cardiorespiratory function as measured by Harvard step test increased to normal rate.

According to Shaver,\textsuperscript{97} endurance training tends to lower the resting heart rate (Brady Cardiac). For instance, in highly trained athletes may be as low or lower than 40-45 beats per minute on the other hand, in healthy but untrained subjects resting heart rates may be as high as 90 to 100 beats per minute. Thus the trained subject is generally characterized as having a low resting heart rate and the untrained as a high resting heart rate.

Gore and others\textsuperscript{98} reported reduction in respiratory rate as an acute effect of ten minutes of Kapalabhati.

Hatha Yoga has become increasingly popular in western countries. This is known about the physiological and psychological effects of yoga practice. Schell\textsuperscript{99} and others

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found that the course of heart rate was significantly different, the yoga group had a decrease during the yoga practice.

Arun\textsuperscript{100} found that although both yogic and non yogic groups showed significant improvement in the cardiorespiratory endurance after experimental period, between the two groups, yoige group showed greater improvement.

Gopal\textsuperscript{101} reported that subjects who were trained for six months in yoga demonstrated a lower heart rate during the performance of a variety of yoga practices than those who performed them without previous training.

The relation of habitual physical activity to various components of health-related fitness as well as the twelve-month repeatability of the measurements was investigated in middle-aged men. Rauramaa\textsuperscript{102} and others found that habitual physical activity

\textsuperscript{100}Arun Nathuji Khodaskar, "Normative Study of the Cant Ability in Male Kabaddi Players and Comparison of the Effects of Selected Yogic and Non-yogic Exercises on the Cardiorespiratory Endurance and Cant Ability", Doctoral Dissertation (Submitted to the University of Nagpur, October 1989).


associated beneficially to cardiorespiratory fitness, body fat and other essential components of health-related fitness in middle-aged men.

Eighty students of certificate course in physical education were studied to investigate the effect of physical training programme on body composition. Fat percentage was calculated from the skin-folds measurements. Physical training programme was administered so as to improve strength, speed and cardiorespiratory endurance. Gill and Brar\textsuperscript{103} found that the percentage of body fat of students at college level reduced significantly as a result of twelve weeks training. The control group did not show any significant change in body fat percentage.

Sternfeld and others\textsuperscript{104} found that decreased fitness was associated with decreased high-density lipo-protein cholesterol and conversely increased fitness was associated with increased high-density lipoprotein cholesterol.


Ranga Reddy conducted a study on the effect of selected yogic practices and physical exercises on obese children. One hundred and forty eight subjects were divided into four groups namely yogic practices group, physical exercises group, swimming training group and control group. He found that the physical exercises group showed a significant difference in reducing body fat over that of yogic practices group.\(^{105}\)

The influence of exercise training on body composition changes in children was examined in terms of muscle, bone and fat development. Because of the excess fat, body composition methodologies in general use and on over-reliance on the two components system-fat and fat-free body the extent of changes especially for muscle and bone with exercise training had not been well qualified. With the recent development of new methodologies these limitations might be overcome. The relationship of body composition to health-related fitness was also explored with an emphasis on establishing fitness standards for body fatness and the need for research on the etiology of lower back pain and osteoporosis.\(^{106}\)


In case of body composition variables as a result of three different modes of training employed in the present study, it was observed that combination of yoga and physical education programme had produced the best result so far as increasing in lean body mass, reduction in fat percentage. Thus, there was reduction in total body weight.\textsuperscript{107}

Tanaka\textsuperscript{108} in his study investigated the relative effects on spot reduction of two types of exercises, one representing the anaerobic and other representing the aerobic model. The aerobic exercise resulted in a four per cent decrease in the percent of body fat approximately one-inch loss in waist girth for the joggers/runners. Anaerobic treatment showed no effect.

Kenney\textsuperscript{109} found that high intensity training is better than low intensity training for improving max VO2 on a treadmill; that male were significantly different from females

\textsuperscript{107}Mahamaya Chowdhury, "Anthropometric and Physiological Changes Resulting from Participation of Physical Education and Yoga Programme", \textit{Doctoral Dissertation} (Submitted to the Jiwaji University, Gwalior, 1990).


for body fat reduction using Nautilus equipment. Results of Boyd's\textsuperscript{110} study on body composition indicated significant increase in body density and lean body weight. The male groups decreased more significantly than females in body fat and body weight. Skin-fold measurements showed significant decrease in Triceps (all groups) and Biceps (all groups except male endurance measurements).

Jokl\textsuperscript{111} found, when he studied adolescent boys and girls in a five-month daily physical training programme, the change in body composition - a significant increase in active tissue and decrease in excess fat at the conclusion of the training programme. The control group, made up of subjects not given to exercise programme, did not experience such changes.

The purpose of Erber's\textsuperscript{112} study was to determine the effects of a prescribed exercise programme on the body composition of young adult men. More specifically, the


study attempted to determine the changes, if any, which occurred in body weight, body
density and percentage of total body fat during a ten-week circuit-training programme.

Wilmore and associates\textsuperscript{113} in their study showed changes in physique for men
aged 17 to 59 years who jogged three days a week for ten weeks. Body composition
changes did occur but they were relatively small. Because lean body weight did not
change, the decrease in body weight was due to a reduction in percentage body fat from
pre test (18.9\%) to post test (17.8\%) values, which represented a fat loss of 1.07 kg. The
reduction in individual skin-folds values paralleled the decrease in body fat.

Forty-eight medalists and forty-eight non-medalists boxers were selected as
subjects. Sports Competition Anxiety Test questionnaire was prepared by Martens to
obtain data to find out the significant difference between medalists and non-medalists.
Factorial Design Analysis of Variance and Scheffe's Post-hoc test were used. Om Prakash
Bhadana and Thirumalaisamy\textsuperscript{114} found that there was significant difference in anxiety
level between medalists and non-medallists groups.

\textsuperscript{113}\textsuperscript{J.H.Wilmore, et al., "Body Composition Changes With a 10 Weeks Program of

\textsuperscript{114}\textsuperscript{Om Prakash Bhadana and R. Thirumalaisamy, "Comparative Analysis of Anxiety
Between Medalist and Non Medalist of National Level Boxers", \textit{Paper presented in
International Conference} (Haryana Agricultural University, Hisar, January 16 -18, 1995).}
Due to non-participation of the youth in regular physical activities, the physical fitness of the general population was slowly decreasing resulting in anxiety and depression, heart disease and spinal disorders increasing.\textsuperscript{115}

Scharff Olson, M. and others,\textsuperscript{116} investigated the acute cardiorespiratory responses to the current "Popularised" style of bench step exercise and validated the use in improving aerobic physical fitness particularly in women. However, no marked difference in relative measures of cardiorespiratory demand has been reported between men and women. Obtained data and training investigations further substantiated the effectiveness of bench / step exercise in promoting physical fitness, including upper body strength. However, the energy cost of bench / step exercise could very dramatically. Important factors such as, the selected step height, exercise rate, imposed step spell, routine format and use of hand held weights. Hand held weight might be more useful for men than women. During training bench / step exercise has been reported to yield a high incidence of grade I injury complaints, particularly in the calf and shoulder region. However, nearly 90% of those complaints were attributable to acute muscle soreness.

\textsuperscript{115}Jose James, "Physical fitness - Issues and Problems", \textit{Paper presented} (Haryana Agriculture University, Hissar (16-18 January 1995)).

Biomechanical research had shown that the ground reaction forces (GRF) experienced during bench stepping were lower than running and directly related to the step height and type of maneuver. In addition compared with novices, instructors exhibited a moderation in the GRF pattern generated during landing. This suggested that learning effect had occurred and that teachers yielded a more considered learning pattern. Finally the activity may be effective in improving body composition but a consideration of factors related to energy expenditure.

Saopinich\textsuperscript{117} conducted a study on the effect of detraining on cardiorespiratory endurance in female high school Basketball players. In this study twenty-one subjects were administered the Skunnen and Rhyming Step Tests. Once in each week for six weeks, following completion of the basket ball season. Although no significant differences were found between heart rate response of the subjects on either test consistently, significant increase in heart rate were recorded during min 1, 2, and 3 of recovery from each tests throughout the detraining period.

Miller and others\textsuperscript{118} found that an intensive but time-limited group stress reduction intervention based on mindfulness meditation could have long-term beneficial effects in the treatment of people diagnosed with anxiety disorders.

The aerobic exercise training was beneficial to prevent physical reconditioning without inducing adverse effects on an individual's joints and general health. A dance-based exercise programme is a safe and efficient activity to improve physical fitness and psychological state in persons with rheumatoid arthritis. A group of nineteen persons (mean age, 49.3±13 year) was put on a twelve week exercise programme (twice weekly), whereas ten persons (mean age 49.4 ± 12 yr) served as controls. After the twelve-week training programme Noreak\textsuperscript{119} and others found positive changes in depression, anxiety, fatigue and tension were observed.


Jambor\textsuperscript{120} and others found that the duration of eight weeks participation both the aqua running exercise and quiet rest sessions could be associated with anxiety.

The effects of circuit weight training on perceived stress, job satisfaction and physical symptoms were investigated in sample of state law enforcement officers. Forty three male officers who were regularly exercising were assigned for four months of circuit weight training which led to a significant increase in strength on cardiovascular fitness, improvements in mood, including decreases in anxiety, depression and hostility.\textsuperscript{121}

After completion of a 12-week aerobic fitness programme, 82 adult participants completed the Back Depression Inventory. Profile of mood status, state level of Anxiety Inventory and the Tennessee Self-concept scale, physiological measure used to assess changes in aerobic fitness were maximal work load, sub maximal heart rate at a standard work load, predicted maximum oxygen uptake and resting heart rate. Exercise participants experienced a positive fitness change and psychological improvement over the initial 12-week programme compared to a control group. After one-year follow up


physiological and psychological benefits remained significantly improved from base line. Overall, results indicated that exercise induced increases in aerobic fitness had beneficial short term and long term effects on psychological outcomes.\textsuperscript{122}

The twelve-month effects of exercise training on psychological outcomes in adults aged 50-60 years were evaluated. The trainees showed reductions in perceived stress and anxiety in relation to controls. Regardless of programme assignment, greater exercise participation was significantly independent of changes in fitness. It was concluded that neither a group format nor a vigorous activity was essential in attaining psychological benefits from exercise training as healthy adults.\textsuperscript{123}

Several researchers have investigated the effects of jogging on the State and Trait Anxiety. Battacharya and Roberts\textsuperscript{124} conducted a study on adults assigned in jogging. They concluded that the joggers became significantly more fit than the others, but there was no reduction in anxiety.

\textsuperscript{122}TM Dilorenzo, \textit{et al.}, "Long Term Effects of Aerobic Exercise on Psychological Outcomes" \textit{Completed Research}, Vol. 28:1(Jan, 1999), pp. 75-85.


Sevier\textsuperscript{125} determined from an administrative stand point of view that there were changes in selected factors of physical fitness and personality in a group of adult women following participation in a six-week programme of aerobic dancing. The subjects were administered the YMCA physical fitness test and three psychological inventory prior to the participation in the programme. Results indicated that the subjects improved significantly in five areas of physical fitness and showed significant changes in four factors of personality, muscular strength, muscular endurance, dominance, share of well being and capacity to create a good impression.

Parks\textsuperscript{126} undertook a study to determine the effects of ten weeks physical fitness programme on selected physiological and psychological variables of elderly fifteen females of 65 to 82 years. Pre and post measurements were obtained for psychological variables. Body composition, flexibility, heart rate and blood pressure were measured. The subjects participated in the fitness programme half an hour in the morning three days a week for ten weeks. Each exercise session began with a ten minutes warming up


followed by fifteen minutes of exercise of moderate intensity. The last five minutes were used as cooling-off period. The 't' test was employed to analyze the data. The following significant changes were found:

(1) The subjects decreased in percentage of body weight. (2) There was an increase in flexibility. (3) There was a decrease in heart rate. (4) Anxiety levels of subjects were observed.

Krishnakanthan\textsuperscript{127} conducted a study to compare the training effects of pranayama and running on selected physiological and psychological variables. Measurements in the criterion variables were taken at the beginning and conclusion of an experimental period of ten weeks. He concluded that the training effects of Pranayama were significantly greater than that of running with respect to respiratory rate, pulse rate and anxiety level all of which have health orientation.

Donoghue and Raphael\textsuperscript{128} in their study tested existing theory concerning the effect of fitness on self-concept for females. Fifty-eight females were tested on measures

\textsuperscript{127} S.Krishnakanthan, "Training Effects of Pranayama and Running", \textit{Ph.D.Dissertation} (Submitted to University of Madras, December 1996).

of fitness, self-concept, body esteem, and perception of fitness. Regression was used to test the fit of the model representing existing theory that fitness affected self-concept indirectly through perception of fitness. It was concluded that fitness might not have a direct effect on females self-concept. The effects were better seen in subject's perception of fitness and levels of body esteem.

Gill and Rao\(^{129}\) conducted a study of self-concept and physical fitness among 169 students of classes IX and X of the Manibai Gujarati Multi purpose Higher Secondary School, Amaravati city. The age level of the subjects was thirteen to eighteen years. The subjects were measured physical fitness by AAHPER Youth Fitness Battery (1973). Pearson's correlation coefficients were computed between composite scores of physical fitness and self-concept. The correlation between scores of physical fitness and self-concept were found to be very low in this study. This might be due to low level of physical fitness in the subjects of this study.

The correlation co-efficient between self-concept and physical fitness was found insignificant at 0.05 level among sports participants among college women and it was found significant among non-sports participants among college women.\textsuperscript{130}

Steefani Spilman\textsuperscript{131} established a study to compare self-concept among students in relation to their physical fitness motor ability and an over all physical performance. This study included 665 girls in grade five, seven and ten as subjects. The subjects were classified into higher and low physical fitness groups according to grade level. The subject's who have scored the top 25\% of all subjects tested were considered as high fitness group. The subjects who had scored the bottom 25\% of all subjects tested were considered as low physical fitness group. The analysis of data revealed that no significant difference was identified when comparing self concept among students in relation to the physical fitness, motor ability and composite score in fifth seventh and tenth grade girls.


Schendel conducted a study on athletes and non-athletes and conducted that at both the athletes displayed more positive personal and social self-concept than the non-athletes.\textsuperscript{132}

Mavilyn\textsuperscript{133} studied the self-concept of non-athletes and athletes. The result showed that participants in physical activities in high school competitive programme scored higher in self-concept scale than those who do not participate.

Jolly Roy\textsuperscript{134} found gymnasts as a group showed higher self-perception scores on behavioral conduct, global self-worth and scholastic competence. Age of gymnast had no significant effect on perceived athletic competence.

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Young\textsuperscript{135} reported significant correlation between various sub-scales scores of Tennessee Self-concept Scale. A significant relationship between self-concept and physical fitness was indicated for seventh grade boys but not for girls or ninth grade boys.

White\textsuperscript{136} concluded that there might be a significant relationship between various selected physical fitness measures classified as strength, flexibility and cardiovascular endurance and certain self-concept sub-scales of the TSCs.

Sorenson\textsuperscript{137} found significant correlation between self-concept and performance on three motor tasks for the sixth grade girls but absence of significant relationship with self-concept and motor performance in first grade children and sixth grade boys.


Black\textsuperscript{138} found no significant differences in self-concept between athletes and non-participants but found significant difference between those of high and low physical skill on physical self-concept, moral and ethical self-concept and family concept.