CHAPTER - II

REVIEW OF RELATED LITERATURE
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The research scholar had come across several books, periodicals, journals, internet and unpublished thesis while searching for relevant facts and findings that are related to his present study. Such of these facts are given below for a better understanding and to justify his study.

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

The literature in any field forms the foundation upon which all future work will be build. If we fail to build foundation of knowledge provided by the review of literature one work is likely to be shadow and that has already done better by some one else.

Gayout states, the breathing exercises of the pranayama have two objects. Firstly, they are physical exercises designed to make the habitual observance of correct breathing easier, just as ordinary
exercises are designed to facilitate the exertion of the complicated movements of our daily existence. Secondly, the may be considered as a medical treatment, which has a most beneficial effect on our Prani body as well as our physical body. If we make up our mind to spend a few minutes every day in doing them, it will not be long before we feel an increase of health and vigour. Some annoying are reduced and sometimes even disappear altogether. The resistance to disease becomes considerable.39

According to Joshi40 Pranayama makes on ideal programme for training of body and mind. He conducted an experiment with criminals of Central Jail. They were given training in Asanas and pranayama for period of 3 months. Remarkable changes were observed in attitudes of mind and body of the criminals. Particularly the balanced mind was development.

Durgalakshmi41 conducted a study on "Effect of Yogic exercise on selected physiological variables of high school boys, "the groups


40L.S. Joshi, Yogic pranayama breathing to long life and good health (Delhi : Orient paper backs, 1986), pp.176-177.

consist of 60 students. The result of the study showed that systolic pressure was increased and diastolic pressure remains unchanged after six weeks training of yoga. The score in breath holding time and vital capacity had also improved. It was statistically significant.

She also recommended that the athletes can adopt these exercises and increase the cardio respiratory function, and further, she adds, the yoga can be included in the regulate programme of physical education in the schools and colleges.

Gharote[^42] evaluated psychological effect of selected yogic exercises on the adolescent high school boys. He used Wenger's battery of test for studying autonomic balance shifting it towards increased parasympathetic function while encouraging trend was observed in the cardio respirated efficiency. A residual effect of this training was also observed even after discontinuing the practice for a period of 2 months.

Gharote, Karambelkar and Bhole\textsuperscript{43} stated that vital capacity in ml and breath holding time in seconds are measured respectively in 147 and 139 males between the ages 18 & 50 before and after a 3 were of training in 20 asanas, two breathing practices and 3 kriyas at nine yoga camps were held during the year 1959 to 69. In Average increase of 15 seconds in breath holding time was observed after the training period, which was found statistically significant.

Sakthignanavel\textsuperscript{44} in his study 30 normal male volunteers had undergone a 12 weeks training course of pranayama, aerobic exercise and pranayama with aerobic exercise. The results shows that the pranayama group marked as higher degree in vital capacity (p<0.05). The aerobic group shows greater cardio respiratory endurance and muscular endurance than the groups. But the combined pranayama aerobic group shows a greater improvement in all aspects than the other 3 groups (p<0.05).


Madanmohan et al\textsuperscript{45} conducted a study on the effect of yoga training on visual and auditory reaction times (RTs), maximum expiratory pressure (MEP), maximum inspiratory pressure (MIP), 40 mg Hg test, breath holding time after inspiration (BHT insp), breath holding after expiration (BHT exp), and hand grip strength (HGS). Twenty seven student volunteers were given yoga training for 12 breath holding after expiration (BHT exp), and hand grip strength (HGS). Twenty seven student volunteers were given yoga training for 12 weeks. Our results show that yoga practice for 12 weeks results in significant increase in respiratory pressures, breath holding times and HGS.

Moorthy\textsuperscript{46} conducted a study on "The effect of selected yogic practices on cardiovascular fitness level of college men and women". His investigation carried out on 10 male and 5 females students of YMCA college, Madras, should significant improvement in cardiovascular fitness after 6 weeks training in yogic practices when measured by Harvard step rest.


Lurtha\cite{47} conducted a study on 36 adolescent males who were divided into three equal groups twelve each. Exercise programme or positive breath holding and negative breath holding were assigned at random of two of the three groups and the third serving as control. Positive breathing holding group practiced Kumbhaka i.e. holding breath after deep slow and full inspiration and negative breath holding group practiced kumbhaka after, slow expiration. Aerobic capacity was measured by the explosive work done by the subjects in leaping six stairs in two steps covering vertical height of 0.87 meter as propounded by Nargaria Kalamon power test. The study proved that practice of pranayama with positive breath holding increases aerobic capacity and practice of pranayama with negative breath holding increases anaerobic capacity.

Channer et al\cite{48} determined that, reported changes in blood pressure during an exercise programme for cardiac rehabilitation following myocardial infarction. Three weeks after they were discharge from the hospital, a sample of 126 patients (90 males and 36 females; average age 56 years; ranging from 39 to 80 years) were

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\begin{itemize}
\item[\textsuperscript{47}] V. Lurtha, "Effect of breath holding on aerobic and anaerobic capacities", \textit{Yoga Mimamsa}, 24:3 (October 1985), p.29.
\end{itemize}
randomly divided into three groups: Tachi, aerobic exercise and a non-exercise support group. Heart rate and blood pressure were recorded before and after each session. At 11 weeks post-discharge, diastolic blood pressure had decreased only in the Tai Chi group (p<0.01). Significant reductions in systolic blood pressure occurred in both exercise groups (both (p<0.05) compared to a control support group.

Gillette and Elsenman\(^{49}\) in their study determined the effect of intensity controlled exercise on the aerobic capacity of overweight middle-aged women. Thirty-eight moderately overweight women, ages 35-57, participated in a 16-week dance exercise programme. Random assignment was made to an experimental group (n=20) in which intensity of exercise was controlled and prescribed, and a control group (n=18) in which exercise was of an intensity typical to commercial aerobic classes. Prior to the onset of training and at the completion of 16 weeks, the following fitness tests were administered: Aerobic capacity expressed as \(\text{VO}_2\text{max}\), body composition analysis, blood chemistry, blood pressure, resting heart rate. It was concluded that a significant improvement was found in the physical fitness.

The lungs can be developed in the arteries through practice of deep breathing exercises. By pranayama, the lungs will get a proper supply of O₂. There will be an improvement in quality and quantity of blood. The process of metabolism will be carried out in efficient manner.⁵⁰

Yoga achieves the aim of promotive health and preventing diseases by cultivating parasympathetic dominance by reconditioning the neuromuscular systems ascending endocrinal various physiological and bio-chemical parameters. It has been observed that there is an improvement in cardio respiratory parameters by way of decrease in the resting pulse rate and blood pressure and increasing in chest expansion, vital capacity maximum breathing capacity and breath holding time.⁵¹

**Bhole and Karambelkar**⁵² investigated the effect of three week programme of Hatha Yoga on physical education students, there was seen to be a statistically significant increases of 15 seconds in breath

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⁵⁰M.V. Bhole, "Effect of Kapalabhati on breath holding time", *Abstracts and Bibliography of Articles on Yoga XII*: 3 (1983), 45.


holding time. The range of increase was seen to be from 10 to 22 seconds.

Dhanraj\textsuperscript{53} reported that 6 weeks practice of 15 minute of Hatha yoga daily, produced a statistically significant (p<0.05) change in breath holding time. This increase of 12 seconds from 54 seconds to 66 seconds was lost. However, when yoga practice was discontinued after 6 weeks of detraining, the average breath holding time was 57 seconds. Another group practiced the 5BX programme for physical fitness for 6 weeks (of detraining, the average breath holding time was 57 seconds. Another group practiced the 5BX programme) showed a much smaller yet statistically significant 4 seconds increase in breath holding time.

Kaur and Kang\textsuperscript{54} were compare the efficiency of two relaxation techniques (music and breathing exercise) and to see if the addition of Biofeedback has any added advantage over these techniques. Sample consisted of 20 student athletes age 18-25 year, 10 male, 10 female) divided randomly into two groups, one group was trained with


breathing exercises where as the other was given music to relax, in the first phase of study. In the second phase of study EMG Biofeedback was added to both the groups. 2 way ANOVA was the tool for statistical analysis. Significant reduction in EMG value of frontalis muscle was observed in all the groups, however BF assisted group showed better result. Moreover, breathing exercises group produced more the muscle group.

Usha et al⁵⁵ was find out "The effect of asanas and pranayamas on selected physical and physiological component. The study has been conducted on 120 boy students between age group 12-16 years. Four groups consisting of 30 students each were formed. This study examined which type of yogic group had the maximum effect on the physical and physiological fitness of subjects. Results showed that every type of yogic exercise improves the physical and physiological fitness but training of asanas and pranayamas collectively can produce the best results.

Jayaveera pandian⁵⁶ was conducted "A study on outcome between physical exercises and yogic exercises on selected physical

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⁵⁶Jayaveera Pandian, V. "A study on outcome between physical exercises and yogic exercises on selected physical and physiological variables
and physiological during off-season among the sports participants". The selected samples have been tested on Abdominal Muscular Endurance, flexibility, systolic blood pressure, diastolic blood pressure and heart rate. From the 150 samples, 90 samples were further screened and they are divided into 3 groups, each one consisting of 30. The subjects have been tested on the criterian measures. For assessing the physiological variables such as systolic blood pressure, diastolic blood pressure and heart rate, the well established reliable instruments such as phygmo manometer and stethoscope have been used in the study. Further to test the physical variables such as flexibility and abdominal muscular endurance standardized test have been adopted in the study, with the tools of stopwatch and scale. The initial means with final means and testing adjusted means is the primary aim of analysis of covariance. It was done in the present study.

The following conclusions are drawn from the present study.

1. The practicing of yogic exercises method evidenced significant improvement over the physical exercises method and control group in abdominal muscular endurance and flexibility.

2. There is a definite response of decreasing heart rate to the practice of yogic exercises as compared to the physical exercises and control group.

3. Systolic blood pressure declines significantly in subjects under yogic exercises practice when compared to the control group. Though the decrement is observed, its effect failed to reach the significant level statistically, when compared with subjects under physical exercises.

4. None of the groups (yogic exercises, physical exercises and control) are superior to other in the reduction in the level of diastolic blood pressure.

5. The physical exercises used in the study had no significant effect on the abdominal muscular endurance and flexibility over the control group.

6. The influence of physical exercises is better in reducing the level of heart rate and systolic blood pressure as compared to the control group.
Moorthy\textsuperscript{57} conducted a study on minimum muscular fitness of school children of age group six to eleven years and compared the influence of selected yogic exercises and physical exercises on them. In that study, 1000 children (517 boys and 429 girls) from second and eleventh standard attended at three schools in Pune. 90 boys and 90 girls from the failure were randomly allotted to control group. Experimental group I. (physical exercises) and Experimental group II (Yogic group) were undergone the treatment for a period of six weeks. He concludes that both experimental groups showed significant improvement was seen much greater in yogic group than in physical exercise group.

Roy\textsuperscript{58} conducted a comparative study of the effect of Asanas and Ballistic exercise of college student of Lakshmibai College of Physical Education, Gwalior. The data was collected in a seven weeks experiment in August to September 1964. The subjects were randomly assigned to two groups. The group ‘A’ was put under a training programme consisting of five selected Asanas. Group ‘B’ was put under a training programme consisting of five ballistic exercises.


analogous to the Asanas. The Asanas and exercises were chosen for their alleged contribution to improved performance in running broad jump. Measurement in running broad jump was taken at the beginning and at the end of experiment.

The mean gains of group ‘A’ and group ‘B’ were tested for significance by ‘t’ test. The difference in the gains made by group ‘A’ and group ‘B’ was also tested by ‘t’ test. This difference was not found to be significant at the 5 per cent level of confidence. Performance in running broad jump can be improved significantly by both Asanas and ballistic exercises.

Gharote et al report in a study 430 school boys in the age group of 6 to 20 years. Yogic training for three weeks showed an improvement of 36.8% in comparison to 20% improvement in minimum muscular fitness.

Giri using a set of yogic exercises studied the effects of the programme for six weeks on the five test of national physical efficiency. Drive, viz., 80 metre sprint, 400 metre run, Cricket ball throw, pull-ups and running broad jump. He found a significant

\footnote{M.L. Gharote, S.K. Ganguly and A.M. Moorthy, “Effect of Yogic training of minimum muscular fitness”, Yoga - Mimamsa, XVIII, No.3 and 4, (October and January 1976), p.20.}
improvement among the experimental group in all the five sets as a result of yogic training however, when the group discontinued the practice, the yogic exercises for the same period of six weeks the effect was significant lost.

Chowdhury Samarendra\textsuperscript{60} the purpose of this study determine the effect of selected Asanas on stride-length in sprinting. The subject were twenty three men students of the Lakshmibai National College of Physical Education, Gwalior. The data was collected in a six-week experiment on commencing from the third week of August 1969. The subjects were randomly assigned to two groups. The group 'A' was selected eight Asanas to improve flexibility of hip, knee and ankle joints. The group 'B' control group. The mean gains, in stride-length made by group 'A' and group 'B' were tested for significance by \textit{t} test. The group 'A' was one percent level of confidence. The difference in gains made by group 'A' over group 'B' was found to be significant at one percent level of confidence. The result of the study under conditions of the experiment, indicate that the length of stride in sprinting might improve significantly by selected Asanas.

\textsuperscript{60}C. Giri, "Yoga and Physical Fitness with Special References to Athletics", \textit{IAHPER}, 6100, 2 (April 1966), pp.2-6.
Choarote, Karambelkar and Bhole\textsuperscript{61} stated that vital capacity in ml and breath holding time in seconds are measured respectively in 147 females and 139 males between ages 18 and 50 before and after a three week of training in 20 Asanas, two breathing practices and three Kriyas at nine yoga camps were held during the year 1959 to 1969. An average increase of 15 seconds in breath holding time was observed after the training period, which was found statistically significant.

Dhanraj\textsuperscript{62} studied that the effects of yoga and the 5 Bx fitness plan on selected physiological parameters. The results indicated increase in basal metabolic rate total volume in basal state, T-4 thryeoxine, hemoglobin, blood cell PWC 130, vital capacity, chest expansion, breath holding time and flexibility after yoga training. Decrease in heart rate were also observed. When yogic training was discontinued for six weeks following in treatment a significant decline in the values of PWC 130, flexibility and breath holding time were noticed.


Murugesan, Govindarajan and Bera\textsuperscript{63} (2000) conducted a study on the basis of medical officers diagnosis, thirty three (N=33) hypertensives, aged 35-65 years, from Govt. General Hospital, Pondicherry, were examined with four variables viz. systolic and diastolic blood pressure, pulse rate and body weight. The subjects were randomly assigned into three groups. The exp. group-I underwent selected yoga practices, Exp. group-II received medical treatment by the physician of the said hospital and the control group did not participate in any of the treatment stimuli. Yoga imparted in the morning and in the evening with 1 hr/session/day for a total period of 11 weeks. Medical treatment comprised drug intake every day for the whole experimental period. The result of pre-post test with ANACOVA revealed that both the treatment stimuli (i.e., yoga and drug) were effective in controlling the variables of hypertension.

Telles, Reddy and Nagendra\textsuperscript{64} (2000) evaluated a statement in ancient yoga texes that suggests that a combination of both “calming” and “stimulating” measures may be especially helpful in reaching a state of mental equilibrium. Two yoga practices, one combining


\textsuperscript{64}S.Telles, SK Reddy and HR. Nagendra, “Oxygen consumption and respiration following two yoga relaxation techniques”. \textit{Appl. Psychophysiol} Biofeedback, 2000; Dec; 25 (4): 221-7.
"calming and stimulating" measures (cyclic meditation) and the other, a "calming" technique (Shavasan), were compared. The oxygen consumption, breath rate, and breath volume of 40 male volunteers (group mean ± SD, 27.0 ± 5.7 years) were assessed before and after sessions of cyclic meditation (CM) and before and after sessions of shavasan (SH). The 2 sessions (CM, SH) were 1 day apart. Cyclic meditation includes the practice of yoga postures interspersed with periods of supine relaxation. During SH the subject lies in a supine position throughout the practice. There was a significant decrease in the amount of oxygen consumed and in breath rate and an increase in breath volume after both types of sessions (2 factor ANOVA, paired t test). However, the magnitude of change on all 3 measures was greater after CM: (1) Oxygen consumption decreased 32.1% after CM compared with 10.1% after SH; (2) breath rate decreased 18.0% after CM and 15.2% after SH; and (3) breath volume increased 28.8% after CM and 15.9% after SH. These results support the idea that a combination of yoga postures interspersed with relaxation reduces arousal more than relaxation alone does.

Raghuraj et al[^65] (1998) studied heart rate variability (HRV) is an indicator of the cardiac autonomic control. Two spectral

components are usually recorded, viz. high frequency (0.15-0.50 Hz), which is due to vagal efferent activity and a low frequency component (0.05 to 0.15 Hz), due to sympathetic activity. The present study was conducted to study the HRV in two yoga practices which have been previously reported to have opposite effects, viz. sympathetic stimulation (Kapalabhati, breathing at high frequency, ie. 2.0 Hz) and reduced sympathetic activity (nadisuddhi, alternate nostril breathing. Twelve male volunteers (age range, 21 to 33 years) were assessed before and after each practice on separate days. The electrocardiogram (lead J) was digitized on line and off-line analysis was done. The results showed a significant increase in low frequency (LF) power and LF/HF ratio while high frequency (HF) power was significantly lower following kapalabhati. There were no significant changes following nadisuddhi. The results suggest that kapalabhati modifies the autonomic status by increasing sympathetic activity with reduced vagal activity. The study also suggests that HRV is a more useful psychophysiological measure than heart rate alone.

Bowman et al\textsuperscript{66} (1997) in their study assessed that the effects of aerobic exercise training and yoga, a non-aerobic control

intervention, on the baroreflex of elderly persons was determined. Baroreflex sensitivity was quantified by the alpha-index, at high frequency (HF; 0.15-0.35 Hz, reflecting parasympathetic activity) and mid-frequency (MF: 0.05-0.15 Hz, reflecting sympathetic activity as well), derived from spectral and cross-spectral analysis of spontaneous fluctuations in heart rate and blood pressure. Twenty six (10 women) sedentary, healthy, normotensive elderly (mean 68 years, range 62-81 years) subjects were studied. Fourteen (4 women) of the sedentary elderly subjects completed 6 weeks of aerobic training, while the other 12 (6 women) subjects completed 6 weeks of yoga. Heart rate decreased following yoga (69 ± 8 vs. 61 ±/− 7 min⁻¹, P < 0.05) but not aerobic training (66 ± 8 vs. 63 ±/− 9 min⁻¹, P = 0.29). VO₂ max increased by 11% following yoga (P < 0.01) and by 24% following aerobic training (P < 0.01). No significant change in alpha MF (6.5 ± 3.5 vs 6.2 ± 3.0 ms mmHg⁻¹, P = 0.69) or alpha HF (8.5 ± 4.7 vs 8.9 ± 3.5 ms mmHg⁻¹, P < 0.01) but not alpha MF (6.5 ± 3.0 vs 7.6 ± 2.8 ms mmHg⁻¹, P = 0.29) increased. Short-duration aerobic training does not modify the alpha-index at alpha MF or alpha HF in healthy normotensive elderly subjects, alpha HF but not alpha MF increased following yoga, suggesting that these parameters are measuring distinct aspects of the baroreflex that are separately modifiable.
Telles et al\textsuperscript{67} (1997) studied the heart rate, breathing rate, and skin resistance were recorded for 20 community home girls (Home group) and for 20 age-matched girls from a regular school (School group). The former group had a significantly higher rate of breathing and a more irregular breath pattern known to correlate with high fear and anxiety, than the school group. Skin resistance was significantly lower in the school group, which may suggest greater arousal, 28 girls of the Home group formed 14 pairs, matched for age and duration of stay in the home. Subjects of a pair were randomly assigned to either yoga or games groups. For the former emphasis was on relaxation and awareness, whereas for the latter increasing physical activity was emphasized. At the end of an hour daily for six months both groups showed a significant decrease in the resting heart rate relative to initial values (Wilcoxon paired sample rest) and the yoga group showed a significant decrease in breath rate, which appeared more regular but no significant increase in the skin resistance. These results suggest that a yoga program which includes relaxation, awareness, and graded physical activity is a useful addition to the routine of community home children.

Raju et al.\(^{68}\) (1997) examined the short-term effects of 4 weeks of intensive yoga practice on physiological responses in six healthy adult female volunteers were measured using the maximal exercise treadmill test. Yoga practice involved daily morning and evening sessions of 90 minutes each. Pre and post-yoga exercise performance was compared. Maximal work output (Wmax) for the group increased by 21% with a significantly reduced level of oxygen consumption per unit work but without a concomitant significant change in heart rate. After intensive yoga training, at 154 Wmin (-1) (corresponding to Wmax of the pre-yoga maximal exercise test) participants could exercise more comfortably, with a significantly lower heart rate (P < 0.05), reduced minute ventilation (P < 0.05), reduced oxygen consumption per unit work (P < 0.05), and a significantly lower respiratory quotient (P < 0.05). The implications for the effect of intensive yoga on cardiorespiratory efficiency are discussed, with the suggestion that yoga has some transparently difference quantifiable physiological effects to other exercises.

Scholl and Allolio and Schonooke\footnote{F.J.Scholl, B.Allolio and OW.Schondoke, "Physiological and psychological effects of Hatha-Yoga exercise in healthy women", \textit{International Journal of Psychosom}, 1994; 41(1-4): 46-52.} (1994) examined the physiological and psychological effects of Hatha-Yoga exercise in healthy women. Hatha-Yoga has become increasingly popular in western countries as a method for coping with stress. However, little is known about the physiological and psychological effects of yoga practice. We measured heart rate, blood pressure, the hormones cortisol, prolactin and growth hormone and certain psychological parameters in a yoga practicing group and a control group of young female volunteers reading in a comfortable position during the experimental period. There were no substantial differences between the groups concerning endocrine parameters and blood pressure. The course of heart rate was significantly different, the yoga group had a decrease during the yoga practice. Significant differences between both groups were found in psychological parameters. In the personality inventory the yoga group showed markedly higher scores in life satisfaction and lower scores in excitability, aggressiveness, openness, emotionally and somatic complaints. Significant differences could also be observed concerning coping with stress and the mood at the end of the experiment. The yoga group had significant higher scores in high spirits and extraverted ness.
Bhargava, Gogate and Mascarenhas\textsuperscript{70} (1988) examined the effect of autonomic responses to breath holding and its variations following pranayama. Autonomic responses to breath holding were studied in twenty healthy young men. Breath was held at different phases of respiration and parameters recorded were Breath holding time, heart rate systolic and diastolic blood pressure and galvanic skin resistance (GSR). After taking initial recordings all the subjects practiced Nadi-Shodhana Pranayama for a period of 4 weeks. At the end of 4 weeks same parameters were again recorded and the results compared. Baseline heart rate and blood pressure (systolic and diastolic) showed a tendency to decrease and both these autonomic parameters were significantly decreased at breaking point after pranayamic breathing. Although the GSR was recorded in all subjects the observations made were not conclusive. Thus pranayama breathing exercises appear to alter autonomic responses to breath holding probably by increasing vagal tone and decreasing sympathetic discharges.

Sundar \textit{et al}\textsuperscript{71} (1984) in their study assessed twenty five patients of essential hypertension were studied. Of these, 20 patients


were not given any antihypertensive drug treatment (Group A); other 5 had to be put on antihypertensive drugs before including them in the study (Group B). These patients were demonstrated “Shavasana” and trained to perform it correctly. Shavasana therapy was continued for six months. There was a statistically significant fall in both mean systolic and diastolic pressure of both groups. Further, there was a significant reduction in doses of antihypertensive drugs, being given to patients of group B. In 65% patients of group A, blood pressure could be controlled with Shavasana only and no drug was needed in them at all. Blood pressure rose significantly to pre-Shavasana levels in patients who left practicing yoga. Thus, with the use of yoga (Shavasana) in therapy of hypertension, requirement of antihypertensive drugs may be significantly decreased and in some cases may be totally dispensed with and it may be an useful adjunct in treatment of hypertension.

**Damodaran et al** (2002) studied the effect of yoga on the physiological, psychological well being, psychomotor parameter and modifying cardiovascular risk factors in mild to moderate hypertensive patients. **METHODS:** Twenty patients (16 males, 4 females) in the age

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group of 35 to 55 years with mild to moderate essential hypertension underwent yogic practices daily for one hour for three months. Biochemical, physiological and psychological parameters were studied prior and following period of three months of yoga practices, biochemical parameters included, blood glucose, lipid profile, catecholamines, MDA, Vit. C. Cholinesterase and urinary VMA. Psychological evaluation was done by using personal orientation inventory and subjective well being. Results showed decrease in blood pressure and drug score modifying risk factors i.e. blood glucose, cholesterol and triglycerides decreased overall improvement in subjective well being and qualify of life. There were decrease in VMA catecholamine, and decrease MDA level suggestive decrease sympathetic activity and oxidant stress. Yoga can play an important role in risk modification for cardiovascular diseases in mild to moderate hypertension.

Kamel et al\textsuperscript{73} (2000) examined the changes in brain waves and blood levels of serum cortisol during yoga exercise in 7 yoga instructors and found that alpha waves increased and serum cortisol

\footnote{\textsuperscript{73} T.Kamel, et al., "Decrease in serum cortisol during Yoga exercise is correlated with alpha wave activation", \textit{Percept Motor Skills}, 2000; Jun; 90(3 Pt 1): 1027-32.}
decreased. These two measures were negatively correlated (r = 0.83). Comparison with a control group of non-practitioners is desirable.

Manchanda et al.\textsuperscript{74} (2000) evaluated the possible role of lifestyle modification incorporating yoga on retardation of coronary atherosclerotic disease. In this prospective randomized, controlled trial, 42 men with angiographically proven coronary artery disease (CAD) were randomized to control (n = 21) and yoga intervention group (n = 21) and were followed for one year. The active group was treated with a user-friendly programme consisting of yoga, control of risk factors, diet control and moderate aerobic exercise. The control group was managed by conventional methods i.e. risk factor control and American Heart Association Step I diet. RESULTS: At one year, the yoga groups showed significant reduction in number of anginal episodes per week, improved exercise capacity and decrease in body weight. Serum total cholesterol, LDL cholesterol and triglyceride levels also showed greater reductions as compared with control group. Revascularisation procedures (coronary angioplasty or bypass surgery) were less frequently required in the yoga group (one versus eight patients; relative risk = 5.45; P = 0.01). Coronary angiography repeated at one year showed that significantly more lesions regressed.

(20% versus 2%) and less lesions progressed (5% versus 37%) in the yoga group (chi-square = 24.9; P < 0.0001). The compliance to the total programme was excellent and no side effects were observed. Yoga lifestyle intervention retards progression and increases regression of coronary atherosclerosis in patients with severe coronary artery disease. It also improves symptomatic status, functional class and risk factor profile.

**Mahajan, Reddy and Sachdeva** (1999) conducted a study on The effect of yogic lifestyle on the lipid status was studied in angina patients and normal subjects with risk factors of coronary artery disease. The parameters included the body weight, estimation of serum cholesterol, triglycerides, HDL, LDL and the cholesterol – HDL ratio. A baseline evaluation was done and then the angina patients and risk factors subjects were randomly assigned as control (n = 41) and intervention (yoga) group (n = 52). Lifestyle advice was given to both the groups. An integrated course of yoga training was given for four days followed by practice at home. Serial evaluation of both the groups was done at four, 10 and 14 weeks. Dyslipidemia was a constant feature in all cases. An inconsistent pattern of change was observed in the control group of angina (n = 18) and risk factor

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subjects (n = 23). The subjects practicing yoga showed a regular decrease in all lipid parameters except IIDL. The effect started from four weeks and lasted for 14 weeks. Thus, the effect of yogic lifestyle on some of the modifiable risk factors could probably explain the preventive and therapeutic beneficial effect observed in coronary artery disease.

Schmidt (1997) evaluated participants of a comprehensive residential three month yoga and mediation training programme living on a low fat lacto-vegetarian diet changes in cardiovascular risk factors and hormones were studied. Substantial risk factor reduction was found. Body mass index, total serum and LDL cholesterol, fibrinogen, and blood pressure were significantly reduced especially in those with elevated levels. Urinary excretion of adrenaline, noradrenaline, dopamine, aldosterone, as well as serum testosterone and luteinizing hormone levels were reduced, while cortisol excretion increased significantly.

Van Monttrans et al\textsuperscript{77} (1990) determined the long term effects of relaxation therapy on 24 hour ambulatory intra-arterial blood pressure in patients with mild untreated and uncomplicated hypertension. DESIGN - Four week screening period followed by randomization to receive either relaxation therapy or non-specific counseling for one year. Ambulatory intra-arterial blood pressure was measured before and after treatment. SETTING - Outpatient clinic in Amsterdam's university hospital. SUBJECTS-35 Subjects aged 20-60 who were being treated by general practitioners for hypertension but were referred to take part in the study. At three consecutive screening visits all subjects had a diastolic blood pressure without treatment of 95-110 mm Hg. Subjects were excluded if they had damaged target organs, secondary hypertension, diabetes mellitus, a cholesterol concentration greater than 8 mmol/l, or a history of malignant hypertension. INTERVENTIONS - The group allocated to relaxation therapy was trained for eight weeks (one hour a week) in muscle relaxation, yoga exercises, and stress management and continued exercising twice daily for one year with monthly visits to the clinic. The control group had the same attendance schedule but had no training and were requested just to sit and relax twice a day. All

subjects were asked not to change their diet or physical activity. **MAIN OUTCOME MEASURE** - Changes in ambulatory intra-arterial blood pressure after one year of relaxation therapy or non-specific counseling. **RESULTS** - Mean urinary sodium excretion, serum concentration of cholesterol, and body weight did not change in either group. Diastolic pressures measured by sphygmomanometry were 2 and 3 mm Hg lower in subjects in the relaxation group and control group respectively at the one year follow up compared with initial readings. The mean diastolic ambulatory intra-arterial pressure during the daytime had not changed after one year in either group, but small treatment effects could not be excluded; the mean change for the relaxation group was −1 mm Hg (95% confidence interval −6 to 3.9 mm Hg) and for the control group - 0.04 mm Hg (-5.3 to 4.6 mm Hg). Mean ambulatory pressure in the evening also had not changed over the year and in both groups night time pressure was 5 mm Hg higher. The variability in blood pressure was the same at both measurements. **CONCLUSIONS**: Relaxation therapy was an ineffective method of lowering 24 hour blood pressure, being no more beneficial than non-specific advice, support, and reassurance-themselves ineffective as a treatment for hypertension.
Pansarc Kulkarni and Pendsc\textsuperscript{78} (1989) determined the effect of yogic training on serum LDL levels. LDH is a glycolytic enzyme utilized during exercise to provide energy to contracting muscles. Chronic submaximal exercise for a longer duration shows about two-fold increase in LDH levels. Yogic practices might be bringing similar effects. The present work was designed to study effect of yogic training on LDH levels. Fourteen female and six male students of average age or 18 years were subjected to yogic training for six weeks. Serum LDH levels were found before and after the training course by spectrophotometer method of Henry \textit{et al.} The serum LDH levels were within normal limits and showed significant increase both in females and males after yogic training. It indicates that Yoga has similar effect on LDL levels like endurance training.

Bowman \textit{et al}\textsuperscript{79} (1997) in their study assessed that the effects of aerobic exercise training and yoga, a non-aerobic control intervention, on the baroreflex of elderly persons was determined. Baroreflex sensitivity was quantified by the alpha-index, at high frequency (HF; 0.15-0.35 Hz, reflecting parasympathetic activity) and mid-frequency (MF:0.05-0.15 Hz, 


reflecting sympathetic activity as well), derived from spectral and cross-spectral analysis of spontaneous fluctuations in heart rate and blood pressure. Twenty six (10 women) sedentary, healthy, normotensive elderly (mean 68 years, range 62-81 years) subjects were studied. Fourteen (4 women) of the sedentary elderly subjects completed 6 weeks of aerobic training, while the other 12 (6 women) subjects completed 6 weeks of yoga. Heart rate decreased following yoga (69 ± 8 vs. 61 ±/− 7 min⁻¹, P < 0.05) but not aerobic training (66 ± 8 vs. 63 ±/− 9 min⁻¹, P=0.29). VO2 max increased by 11% following yoga (P< 0.01) and by 24% following aerobic training (P < 0.01). No significant change in alpha MF (6.5 ± 3.5 vs 6.2 ± 3.0 ms mmHg⁻¹, P = 0.69) or alpha IIIF (8.5 ± 4.7 vs 8.9 ± 3.5 ms mmHg⁻¹, P < 0.01) but not alpha MF (6.5 ± 3.0 vs 7.6 ± 2.8 ms mmHg⁻¹, P - 029) increased. Short-duration aerobic training does not modify the alpha-index at alpha MF or alpha HF in healthy normotensive elderly subjects, alpha HF but not alpha MF increased following yoga, suggesting that these parameters are measuring distinct aspects of the baroreflex that are separately modifiable.

Telles et al.⁸⁰ (1997) studied the heart rate, breathing rate, and skin resistance were recorded for 20 community home girls (Home group) and for 20 age-matched girls from a regular school (School group). The

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former group had a significantly higher rate of breathing and a more irregular breath pattern known to correlate with high fear and anxiety, than the school group. Skin resistance was significantly lower in the school group, which may suggest greater arousal, 28 girls of the Home group formed 14 pairs, matched for age and duration of stay in the home. Subjects of a pair were randomly assigned to either yoga or games groups. For the former emphasis was on relaxation and awareness, whereas for the latter increasing physical activity was emphasized. At the end of an hour daily for six months both groups showed a significant decrease in the resting heart rate relative to initial values (Wilcoxon paired sample rest) and the yoga group showed a significant decrease in breath rate, which appeared more regular but no significant increase in the skin resistance. These results suggest that a yoga program which includes relaxation, awareness, and graded physical activity is a useful addition to the routine of community home children.

Raju et al\textsuperscript{81} (1997) examined the short-term effects of 4 weeks of intensive yoga practice on physiological responses in six healthy adult female volunteers were measured using the maximal exercise treadmill test. Yoga practice involved daily morning and evening sessions of 90 minutes each. Pre and post-yoga exercise performance was compared.

Maximal work output (Wmax) for the group increased by 21% with a significantly reduced level of oxygen consumption per unit work but without a concomitant significant change in heart rate. After intensive yoga training, at 154 Wmin (-1) (corresponding to Wmax of the pre-yoga maximal exercise test) participants could exercise more comfortably, with a significantly lower heart rate (P < 0.05), reduced minute ventilation (P < 0.05), reduced oxygen consumption per unit work (P < 0.05), and a significantly lower respiratory quotient (P < 0.05). The implications for the effect of intensive yoga on cardio-respiratory efficiency are discussed, with the suggestion that yoga has some transparently different quantifiable physiological effects to other exercises.

Scholl and Allolio and Schonooke\(^{82}\) (1994) examined the physiological and psychological effects of Hatha-Yoga exercise in healthy women. Hatha-Yoga has become increasingly popular in western countries as a method for coping with stress. However, little is known about the physiological and psychological effects of yoga practice. We measured heart rate, blood pressure, the hormones cortisol, prolactin and growth hormone and certain psychological parameters in a yoga practicing group and a control group of young female volunteers reading in a comfortable position during the experimental period. There were no

substantial differences between the groups concerning endocrine parameters and blood pressure. The course of heart rate was significantly different; the yoga group had a decrease during the yoga practice. Significant differences between both groups were found in psychological parameters. In the personality inventory the yoga group showed markedly higher scores in life satisfaction and lower scores in excitability, aggressiveness, openness, emotionally and somatic complaints. Significant differences could also be observed concerning coping with stress and the mood at the end of the experiment. The yoga group had significant higher scores in high spirits and extraverted ness.

Bhargava, Gogate and Mascarenhas\(^8\) (1988) examined the effect of autonomic responses to breath holding and its variations following pranayama. Autonomic responses to breath holding were studied in twenty healthy young men. Breath was held at different phases of respiration and parameters recorded were Breath holding time, heart rate systolic and diastolic blood pressure and galvanic skin resistance (GSR). After taking initial recordings all the subjects practiced Nadi-Shodhana Pranayama for a period of 4 weeks. At the end of 4 weeks same parameters were again recorded and the results compared. Baseline heart rate and blood pressure (systolic and diastolic) showed a

tendency to decrease and both these autonomic parameters were significantly decreased at breaking point after pranayamic breathing. Although the GSR was recorded in all subjects the observations made were not conclusive. Thus pranayama breathing exercises appear to alter autonomic responses to breath holding probably by increasing vagal tone and decreasing sympathetic discharges.

**Sundar et al**<sup>84</sup> (1984) in their study assessed twenty five patients of essential hypertension were studied. Of these, 20 patients were not given any antihypertensive drug treatment (Group A); other 5 had to be put on antihypertensive drugs before including them in the study (Group B). These patients were demonstrated “Shavasana” and trained to perform it correctly. Shavasana therapy was continued for six months. There was a statistically significant fall in both mean systolic and diastolic pressure of both groups. Further, there was a significant reduction in doses of antihypertensive drugs, being given to patients of group B. In 65 % patients of group A, blood pressure could be controlled with Shavasana only and no drug was needed in them at all. Blood pressure rose significantly to pre-Shavasana levels in patients who left practicing yoga. Thus, with the use of yoga (Shavasana) in therapy of hypertension, requirement of antihypertensive drugs may be significantly

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decreased and in some cases may be totally dispensed with and it may be an useful adjunct in treatment of hypertension.

**Damodaran et al**\(^{85}\) (2002) studied the effect of yoga on the physiological, psychological well being, psychomotor parameter and modifying cardiovascular risk factors in mild to moderate hypertensive patients. METHODS: Twenty patients (16 males, 4 females) in the age group of 35 to 55 years with mild to moderate essential hypertension underwent yogic practices daily for one hour for three months. Biochemical, physiological and psychological parameters were studied prior and following period of three months of yoga practices, biochemical parameters included, blood glucose, lipid profile, catecholmines, MDA, Vit. C. Cholinesterase and urinary VMA. Psychological evaluation was done by using personal orientation inventory and subjective well being. Results showed decrease in blood pressure and drug score modifying risk factors i.e. blood glucose, cholesterol and triglycerides decreased overall improvement in subjective well being and qualify of life. There were decrease in VMA catecholamine, and decrease MDA level suggestive decrease sympathetic activity and oxidant stress. Yoga can play an important role in risk modification for cardiovascular diseases in mild to moderate hypertension.

Kamel et al\textsuperscript{86} (2000) examined the changes in brain waves and blood levels of serum cortisol during yoga exercise in 7 yoga instructors and found that alpha waves increased and serum cortisol decreased. These two measures were negatively correlated ($r = -0.83$). Comparison with a control group of non-practitioners is desirable.

Manchanda et al\textsuperscript{87} (2000) evaluated the possible role of lifestyle modification incorporating yoga on retardation of coronary atherosclerotic disease. In this prospective randomized, controlled trial, 42 men with angiographically proven coronary artery disease (CAD) were randomized to control ($n = 21$) and yoga intervention group ($n = 21$) and were followed for one year. The active group was treated with a user-friendly programme consisting of yoga, control of risk factors, diet control and moderate aerobic exercise. The control group was managed by conventional methods i.e. risk factor control and American Heart Association Step I diet. RESULTS: At one year, the yoga groups showed significant reduction in number of anginal episodes per week, improved exercise capacity and decrease in body weight. Serum total cholesterol, LDL cholesterol and triglyceride levels also showed greater reductions as compared with control group. Revascularisation procedures (coronary


angioplasty or bypass surgery) were less frequently required in the yoga group (one versus eight patients; relative risk – 5.45; P – 0.01). Coronary angiography repeated at one year showed that significantly more lesions regressed (20% versus 2%) and less lesions progressed (5% versus 37%) in the yoga group (chi-square = 24.9; P < 0.0001). The compliance to the total programme was excellent and no side effects were observed. Yoga lifestyle intervention retards progression and increases regression of coronary atherosclerosis in patients with severe coronary artery disease. It also improves symptomatic status, functional class and risk factor profile.

Mahajan, Reddy and Sachdeva (1999) conducted a study on The effect of yogic lifestyle on the lipid status was studied in angina patients and normal subjects with risk factors of coronary artery disease. The parameters included the body weight, estimation of serum cholesterol, triglycerides, HDL, LDL and the cholesterol – HDL ratio. A baseline evaluation was done and then the angina patients and risk factors subjects were randomly assigned as control (n = 41) and intervention (yoga) group (n = 52). Lifestyle advice was given to both the groups. An integrated course of yoga training was given for four days followed by practice at home. Serial evaluation of both the groups was done at four, 10 and 14 weeks. Dyslipidemia was a constant feature in

all cases. An inconsistent pattern of change was observed in the control group of angina (n = 18) and risk factor subjects (n = 23). The subjects practicing yoga showed a regular decrease in all lipid parameters except IIDL. The effect started from four weeks and lasted for 14 weeks. Thus, the effect of yogic lifestyle on some of the modifiable risk factors could probably explain the preventive and therapeutic beneficial effect observed in coronary artery disease.

Schmidt (1997) evaluated participants of a comprehensive residential three month yoga and mediation training programme living on a low fat lacto-vegetarian diet changes in cardiovascular risk factors and hormones were studied. Substantial risk factor reduction was found. Body mass index, total serum and LDL cholesterol, fibrinogen, and blood pressure were significantly reduced especially in those with elevated levels. Urinary excretion of adrenaline, noradrenaline, dopamine, aldosterone, as well as serum testosterone and luteinizing hormone levels were reduced, while cortisol excretion increased significantly.

Van Monttrans et al (1990) determined the long term effects of relaxation therapy on 24 hour ambulatory intra-arterial blood pressure.


in patients with mild untreated and uncomplicated hypertension. DESIGN – Four week screening period followed by randomization to receive either relaxation therapy or non-specific counseling for one year. Ambulatory intra-arterial blood pressure was measured before and after treatment. SETTING – Outpatient clinic in Amsterdam’s university hospital. SUBJECTS-35 Subjects aged 20-60 who were being treated by general practitioners for hypertension but were referred to take part in the study. At three consecutive screening visits all subjects had a diastolic blood pressure without treatment of 95-110 mm Hg. Subjects were excluded if they had damaged target organs, secondary hypertension, diabetes mellitus, a cholesterol concentration greater than 8 mmol/l, or a history of malignant hypertension. INTERVENTIONS - The group allocated to relaxation therapy was trained for eight weeks (one hour a week) in muscle relaxation, yoga exercises, and stress management and continued exercising twice daily for one year with monthly visits to the clinic. The control group had the same attendance schedule but had no training and were requested just to sit and relax twice a day. All subjects were asked not to change their diet or physical activity. MAIN OUTCOME MEASURE - Changes in ambulatory intra-arterial blood pressure after one year of relaxation therapy or non-specific counseling. RESULTS – Mean urinary sodium excretion, serum concentration of cholesterol, and body weight did not change in either group. Diastolic pressures measured by sphygmomanometry were 2 and
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Pansarc Kulkarni and Pendsc⁹¹ (1989) determined the effect of yogic training on serum LDL levels. LDH is a glycolytic enzyme utilized during exercise to provide energy to contracting muscles. Chronic submaximal exercise for a longer duration shows about two-fold increase in LDH levels. Yogic practices might be bringing similar effects. The present work was designed to study effect of yogic training on LDH levels. Fourteen female and six male students of average age or 18 years were

subjected to yogic training for six weeks. Serum LDH levels were found before and after the training course by spectrophotometer method of Henry et al. The serum LDH levels were within normal limits and showed significant increase both in females and males after yogic training. It indicates that Yoga has similar effect on LDL levels like endurance training.

**M.S. Balasubramanian and B. Pansare** conducted a study on “Effect of Yoga on Aerobic and Anaerobic Power of Muscles”. Aerobic power (VO₂ max) and anaerobic power were estimated in medical students before and after six weeks of yogic training. A significant increase in aerobic power and a significant decrease in anaerobic power was observed. This may be due to conversion of some of the Fast Twitch (F.T) muscle fibres into slow Twitch fibres (S.T) during yogic training.⁹²

**D.D. Madanmohan**⁹³, et.al conducted a study on the effect of yoga training on visual and auditory reaction times (RTs), maximum expiratory pressure (MEP), maximum inspiratory pressure (MIP), 40

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mg Hg 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. Our results 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.

S.K. Ganguly and M.L. Gharote\textsuperscript{94} conducted a study to determine the effect of yogic training on endurance and flexibility. The study was conducted on 70 students of the Regional Police Training School (RPTS), Khandala, from which 35 students were assigned to each of the experimental and control groups. Significant lowering of the sitting pulse rate was observed in the experimental group as compared to the control group. The cardiovascular endurance as judged by the Harvard Step Test improved significantly in the experimental group. Although mean increases in the Toe Touch flexibility was observed in the experimental group, it did not reach the expected statistical significance.

V.K. Kanade and M.L. Garote\textsuperscript{95} conducted a study on yogic training for the promotion of physical fitness and selected athletic events.

The purpose of this study was to investigate whether additional training in selected yogic exercises will be of benefit in the improvement of physical fitness and in the performance of high jump and 1500 M run, 60 students from B.P. Ed. College, Bombay were randomly selected and divided into three groups for experiment. Gr. A received training in selected asanas, Gr. B was given training in asanas plus some breathing exercises and Gr. C was treated as control. The result of 6 weeks training period revealed an improved physical fitness with reference to high jump and 1500 M run.

M.L. Garote\textsuperscript{96} conducted a study to determine the "Effect of everyday and alternate day yoga training on the Physical Fitness of School Children". In his study were school boys with means age of 17 years when tested with the Fleishman battery of basic physical fitness tests showed significant improvement with six weeks yoga training


\textsuperscript{96}M.L. Gharote, "Effect of everyday and alternate day yoga training on the Physical Fitness of School Children", Ayurveda and Yoga, 27 (July 1987), 9-15.
given for 6 days a week as well as for 3 days a week in comparison to the control group.

V. Lurtha\textsuperscript{97} conducted a study on 36 adolescent males, who were divided into three equal groups of twelve each. Exercise programme of positive Breath Holding and negative breath holding were assigned at random of two of the three groups and the third serving as control. Positive breathing holding group practiced kumbhaka i.e. holding breath after deep slow and full inspiration and negative breath holding group practiced kumbhaka after slow expiration. Aerobic capacity was measured by the explosive work done by the subjects in leaping six stairs in two steps covering vertical height of 0.87 meter as propounded by Margaria Kalamon power test. The study proved that practice of pranayama with positive breath holding increases aerobic capacity and practice of pranayama with negative breath holding increases anaerobic capacity.

Beras\textsuperscript{98} training schedule (BTS), a proposed tool for improvement in performance of some selected events in track and field

\textsuperscript{97} V.Lurtha, "Effect of Breath Holding on Aerobic and Anaerobic Capacities", Yoga Mimamsa, 24:3 (October 1985), P.29.

athletics (100M run, running broad jump, shotput, running high jump, 200 M run and 800 M run), was developed using the principles of yoga, psychology and physical training. The five potential dimensions incorporated in BTS on the basis of results of various research reports were relaxation, practice of mental imagery, demonstration of high quality of athletic performance, practice of specific athletic skills, error correction and discussion between the athlete and the coach. The face validity of BTS was established. To test the effectiveness of the BTS vis-à-vis performance in selected athletic events, a vertical teaching model (VTM) was compared with BTS in an experimental design. 120 subjects age 20 to 30 years were participated in the experiment. The experiment consisted of the two treatment groups (BTS & VTM) and one control group designed separately for men and women subject. The data were analysed after a treatment period of 6 weeks, using ANCOVA and Scheffe's post hoc technique. The result of this study revealed that Bera's training schedule (BTS) showed a better impact in improving physical performance of the selected events in track and field athletics.
T.K. Bera and M.V. Rajapukar\textsuperscript{99} (1990) in their study forty male high school students, age 12-15 years participated for a study of yoga in relation to body composition, cardiovascular endurance and anaerobic power. The Ss were placed into two subsets viz. Yoga group and control group. Body composition, cardiovascular endurance and anaerobic power were measured using standard method. The duration of experiment was one year. The result of ANCOVA revealed that a significant improvement in ideal body weight, body density, cardiovascular endurance and anaerobic power was observed as a result of yoga training. This study could not show significant change in body fat (mid auxiliary), skeletal diameters and most of the body circumferences. It was evident that some of the fat folds (triceps, subscapular, suprailiac, umbilical, thigh and calf) and body circumferences (waist, umbilical and hip) were reduced significantly.

P.S. Raju \textit{et.al.},\textsuperscript{100} conducted a study on twenty normal healthy volunteers (6 males and 6 females) undergoing yoga training for 90 days were studied for the effect of yoga on exercise tolerance. Their ages ranged from 18 to 28 years. The volunteers were taught


only pranayama for the first 20 days (Phase I) and after 90 days of yoga training (Phase II) pyruvate and lactate in venous blood and blood gases in capillary blood were estimated immediately before and after the exercise. Minute ventilation and oxygen consumption were estimated before and during the test. Post exercise blood lactate was elevated significantly during initial and Phase I; but not in Phase II, there was significant reduction of minute ventilation and oxygen consumption only in males in phase I and II at the time when the volunteers reached their 80% of the predicted heart rate. Female volunteers were able to go to high loads of exercise in phase I and II.

**Jackie**\(^{101}\) (1985) reported on the circulatory-respiratory effect of aerobic dancing as evaluated by Cooper's twelve minute run/walk test for one hundred and fifty girls and women ages thirteen to fifty one years. A portion of the group served as a control while the reminder participate in the twelve weeks of aerobic dancing. On the initial twelve minute test, sixty one per cent were in Cooper's very poor or poor fitness categories. After participating in the aerobic dance sessions, only twenty seven persons were in these categories, twenty five per cent were in the good and three per cent were in the excellent categories. The control subjects showed little change.

Ghundiyal Santosh\textsuperscript{102} (1988) in his study compared the effect of Aerobic and Anaerobic exercises on the physical fitness of the leper School students of Tapowan. A total of 60 students were selected from the 9\textsuperscript{th} and 10\textsuperscript{th} grade of Tapowan School, Amravati (age ranged from 13 to 19 years. The AAHPER youth fitness tests were administered and further were divided in three homogenous groups. Six week training programme of aerobic and anaerobic exercised were given to Group ‘A’ and ‘B’ respectively and final data was collected by the AAHPER test administration. Significance of mean differences among the groups were computed by 'F' ratio test. It was concluded that a significant improvement was found in the physical fitness of a leper student because of aerobic and anaerobic exercises.

Anshel\textsuperscript{103} (1985) has expounded on how aerobic dance can provide rewards to athletes in particular. The advantages can be divided into psychological and physiological categories. Psychological advantages include the athlete's ability to (1) move in synchronization to music, enhancing, co-ordination and the ability to move in a series of synchronized movements (2) Focus attention on external stimuli, (3)

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\textsuperscript{103} Anshel Mark (1985), "Aerobic Dance for Athletics", Athletic Journal 65.9, 16-18, 43.
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Provide a release from the anxiety accompanied with sports, daily training and pressure to succeed, (4) provide an enjoyable, yet challenging, supplement in one’s quest for fitness, (5) Enhance kinaesthetic awareness, and (6) Enhance group / team cohesiveness. Physiological advantages include the following, all of which allow for injury prevention: (1) providing a total work out, supplementing the specific nature of the particular sport, (2) strengthening abdominal muscles, (3) improvement of running mechanics, and (4) improved flexibility.

Pelin Alten conducted a study to examine the effects of a 3-month aerobics and weight-lifting added aerobics on body composition, serum lipids, lipoproteins and cardio and cardio vascular fitness in middle-aged women.

Thirty healthy sedentary women (mean age 42.83 ± 11.02) take part in the study. Before starting the exercises their blood samples, peripherical measurements and thickness of skin folds were taken. They were subjected to a one hour aerobics (n=20) and weight-lifting added aerobics (n=10) sessions 3 times a week. The intensity of the

exercises was decreased gradually and their heart beats were raised up to 130-140 per minute at the end of sessions.

In the group having aerobics and weight-lifting added aerobics, there were no significant differences in their blood parameters, peripheric and skinfold thickness according to the exercise types they had taken (p>0.05).

According to the study, it was concluded that at 3 months aerobics and weight-lifting added aerobics have positive effects on physical fitness and cardio vascular system in middle-aged sedentary women.

C.B. Silverman\textsuperscript{105} et al., conducted a study to determine the safety, feasibility and consequences of a program of progressive strength training and cardio vascular fitness training in women with fibromyalgia syndrome (FMS).

Fifteen women with confirmed FMS were monitored for injury and exercise compliance, and assessed for muscle strength (1-repetition maximum technique), cardio vascular endurance

\textsuperscript{105} C.B. Silverman et al., "The Effect of progressive strength training and aerobic exercise on muscle strength and cardio vascular fitness in women with Fibromyalgia", Arthritis Rheum, 47:22, (February 2002), P.8.
(6-minute walk test), and functional status (Fibromyalgia Impact Questionnaire (FIQ)) before and after a 20 week exercise intervention.

A program of progressive strength training and cardiovascular exercise can be safe, well tolerated, and effective at improving muscle strength, cardiovascular endurance and functional status in women with FMS without exacerbating symptoms. This program may also contribute to a reduction in the severity of several symptoms.