Section III

Review of the literature
3. Review of the literature

3.1 Health and Exercise

The importance of exercise in the human beings is to maintain the general health properly. If all of the muscles or part of it are allowed to remain unused for a long time they reduce in size, grow softer and finally become sluggish and debilitated. By use and exercise, muscles become strong and healthy.

The muscular exercise of the body should be regular and moderate in degree in order to produce proper effect. It is not advisable for any person to remain inactive for a long time and do vigorous exercise in one fine morning. An unnatural deficiency of this kind cannot be compensated by an occasional excess. Exercise which is so violent and long continued as to produce exhaustion or unnatural fatigue is as injury instead of an advantage and creates a waste and expenditure of muscular force instead of its healthy increase.

3.1.1 Isometric and isotonic exercise

Based on the type of muscular contraction exercise is of two types. One is isometric exercise where the muscular length remains almost same without any change in the force during contraction procedure. Here no external work is performed. The example of an isometric exercise is to push a very large, heavy stone. The other type of exercise is isotonic exercise where muscular length vary continuously during contraction but the force generated in the muscles remain same. The example of this type of exercise is to raise a dumbbell from the extended to the flexed elbow position or to lower the dumbbell from the flexed to the extended elbow position. Ideally, to speak, there is no such exercise where purely isometric or isotonic types of muscle contraction occur.

3.1.2 Different forms of exercise

There are various types of exercise. Walking is one of the most useful kinds of exercise, since it is easy and muscles are not overstressed and may be continued for a long time without fatigue. Riding on horseback is also efficacious as it accompanies certain amount of excitement apart from the exercise part. Running and leaping being more violent should be done in an economical way. For children, the rapid and continuous exercise
which is a part and parcel of their various games and amusements is the best means of their exercise programme. Now a days more emphasis is given on the stretching exercise. Stretching exercise may be of neck stretch, calf stretch, thigh stretch, hip stretch, spinal twist, cross over stretch and lumbar stretch only to name a few.

3.1.3 Exercise training and its effect on muscular strength

Muscles become stronger in response to overload training. Overload is created by either increasing the load, increasing the speed of muscle action or through a combination of increasing both the load and speed. A load of between of 60-80% of a muscle force generating capacity usually represents a sufficient overload to produce strength gains. Progressive resistance weight training, isometric training and isokinetic training are commonly three exercise systems in the overloading principles of muscles. Each system results in strength gain that are highly specific to the type of training. Isokinetic training, because of possibility for generating maximum force throughout the full range of joint motion at different angular velocities of limb movement, offer a unique method of resistance training (117).

3.1.4 Objectives of Exercise

It should be remembered that object of exercise is not the mere acquisition or increase of muscular strength. A special increase of strength may be produced to a great extent by a constant practice or training of particular muscles or muscles groups. Thus, the arms of the blacksmith and legs of dancer become developed in excessive proportion. Similarly, by the continued practice in a gymnasium of raising weights or carrying loads, the muscular systems generally may be greatly increased. But this unusual muscular development is not necessary to help and is not even particularly beneficial. The best condition is that in which all the different organs and systems of the body should develop completely so that no organs or systems preponderate excessively over the others. The most usual kind of exercise employs equally all the limbs and cultivates agility and freedom of movement, as well as simple muscular strength.

The exact quantity of exercise is not ideally the same for different persons, but should be measured in terms of its effects. However, in all the cases the exercise that is
taken should be regular, moderate and uniform in degree and should be repeated as nearly as possible for the same time everyday.

3.2 Yogic Exercise

The importance of exercise was realized by the Indian Philosophers and sages a long time back before the development of various conventional forms of exercise. They not only realized the importance of physical exercise but they emphasized also on the mental aspects of exercise. Without psychological elevation or improvement in mental function, mere physical exercise is not producing better effects of exercise. Thus, a mental aspect of exercise has a major role in the beneficial effects of exercise. The present day exercise scientists are trying to correlate the mental aspects of exercise with the release of a hormone namely β-endorphin (69). β-endorphin is an opioid peptide. Their role during exercise is still debated, but they are assumed to cause euphoria, exhilaration. Endorphin secretion has been implicated in increased pain tolerance, improved appetite control and a reduction in anxiety, tension, anger and confusion- all of which are proposed psychological benefits of regular exercise (130,275). Endorphin levels increase as much as five times during exercise with even higher values probably occurring in the brain itself (72,158).

Indian philosophers and sages after realizing the importance of mental aspects of exercise they have blended physical aspects of exercise with mental aspects and have given the form of Yogic exercise. A major portion of Yogic exercise consists of mental aspects. Yoga is an ancient Indian culture and way of life for physical, mental well being of a human being. Yogic exercise is performed slowly and it is essential for a Yogic practitioner to feel always (conscious awareness) the movement of different body parts as well as the breathing (188, 218). Psycho physiological changes due to Yogic practice (196, 257) may act with changes in optimum autonomic nervous and neuroendocrine activity (84).

3.3 Yoga and Cardiovascular system

Yoga is an ancient Indian culture and way of life for the physical, mental and spiritual well being of the human being. During the last three decades extensive physiological research have been done on yogic practices. Scientific community has been gradually accepting yoga as one of the ways for balanced physical and mental development as well as for the alleviation of various stress related diseases. There are various reports
regarding the changes in different physiological system individually during the yogic practice and also the improvement of physiological, biochemical and psychological parameters on practice of yoga.

Shanker Rao (167) studied the cardiovascular response during headstand posture (Shirsasana). He observed that high-pressure capacity vessels between the heart level and posterior tibial artery had very little nervous control. The high-pressure baroreceptors took active part in postural adjustment of circulation. Blood pressure equating mechanism is not as efficient when vital tissues are pooled with blood as when blood supply to them reduced. Karambelkar et al (88) had studied on certain asanas and reported that properly performed asana i.e. posture involving more of cerebellar activity exhibits relaxed condition of the related muscle which otherwise show increased electrical activity if the same condition is maintained with the help of isometric contraction (Exercise involving more of motor cortex). Experimental study was performed on yogis who claimed to be able to control or stop their heartbeat voluntarily (3). Study by Wenger, Bagchi and Anand on three yogis showed that they could increase the abdominal and thoracic pressure with muscular effort with glottis closed. This could reduce the venous return to such an extent that pulse could not be felt but heart continue to beat as evidenced by E.C.G. One of the three yogis could achieve a decrease in heart rate accompanied by disappearance of F-wave (7,266).

Kothari et al (93,94) experimented on a yogi who spent seven days in a pit had E.C.G. silence for last five days of its stay. Just half an hour before the pit was opened the E.C.G. reappeared with sinus tachycardia of 142 beats / minute.

It has also been reported that a yogi could control hand blood flow as shown by a difference of 10°C between the temperature of thenar and hypothenar eminence of the same hand (20). Benson et al (13) showed that thermoregulatory efficiency could be voluntarily modulated by the practice of g-Tum-mo Yoga of Tibetan origin.

It is well reported that with a few months of Hatha Yoga training there is an improvement in cardiovascular fitness as assessed by Harvard Step Test and there is also an increase in physical work capacity at a given heart rate for example 130 - 170 beats / minute (20). It has also been shown that yogic practice for a longer period leads to more parasympathotonic types of responses and shift autonomic nervous system balance of an
individual towards parasympathodominance (207,246). Wallace et al showed that yogis could reduce oxygen consumption and heart rate voluntarily (262).

Various investigators reported that the practice of Yogic exercise led to a relative hypometabolic state (84,207,52,262-263). Jacques Mayol who held the world record in breath hold diving attributed his success to Yogic practices (113). It has been shown by Selvamurthy et al (209) that sluggish baroreflex mechanism in essential hypertension patients could be reactivated following three weeks course of yogic asana. Bernardi et al observed the effect of rosary prayer and Yoga mantras on autonomic cardiovascular rhythms. They found that both the prayer and mantra caused striking powerful and synchronous increase in cardiovascular rhythms when recited six times a minute. Baroreflex sensitivity also increased significantly from 9.5 ms/mmHg to 11.5 ms/mmHg (17).

Peng et al (152) observed the heart rate oscillations during two meditation techniques associated with slow breathing in Chinese Chi and Indian Kundalini Yoga meditation. They reported that heart rate oscillations increased prominently during these practices.

Telles et al (247) observed that during meditation by experienced meditators with chanting of ‘OM’ heart rate reduced significantly as compared to control. The effects of unilateral forced nostril breathing on the heart rate and end diastolic volume was studied by Shannahoff et al (213) They showed that forced right nostril breathing increased the heart rate than the forced left nostril breathing and end diastolic volume was increased prominently in left nostril breathing.

The practice of very high frequency Yogic breathing (Kapal Bhati) increased the heart rate by 9 beats per minute and increased the systolic, diastolic blood pressure by 15 mm Hg and 6mm Hg respectively during the practice (226).

In another study Stancak et al (224) observed the respiratory and cardiovascular rhythmicities during Kapal Bhati and he opined the integrative role of cardiovascular and respiratory rhythms during the Yogic high frequency breathing.
There is report regarding the effect of practicing Nadi Shodhana Pranayama on the autonomic nervous responses as assessed by heart rate, blood pressure. The basal heart rate and blood pressure was reduced following the Pranayama training for one month (18).

Belaia et al observed the effect of certain Yogic Asanas on the central nervous and cardiovascular systems (12). Muralidharan et al studied the effect of Yogic practice on cardiac recovery index (135).

Oxygen consumption and breathing pattern was observed after two Yoga relaxation techniques by Telles et al (252). Heart rate and respiratory rate alterations in different types of Pranayama and meditation was observed by Telles et al in two separate studies (240-241).

Influence of Yoga training on blood coagulation was studied by Chohan et al (32).

Effect of Yoga type of breathing on heart rate and cardiac axis of normal subjects was studied by Mohan et al (123).

Raju et al studied the effects of intensive Yoga training on physiological changes in six adult women. He also compared the Yogic exercise with physical exercise in another study (164,165). In a number of studies Gopal et al observed cardiovascular and respiratory functioning during Asana, Pranayama and Bandha (61,63-64). Cardiovascular responses during Sarvangasana (head down body up posture exercise) was studied by Konar et al (92). Left ventricular filling during head stand and inverted postures was studied by Minavaleev et al (121).

3.4 Cardiorespiratory and metabolic aspects of Yoga

Certain studies related to cardiorespiratory and metabolic responses during yogic practice and the effect of yogic training on cardiorespiratory and metabolic responses of the subjects are well documented. Shankar Rao reported the energy cost of standing on head was 336ml. or 1.62 kcal./min and the energy cost during suspension by feet was 300ml. (168). In another study he showed that vital capacity was minimum in head down posture and maximum in the standing erect posture. Little variation is seen in residual volume and total lung capacity in supine, erect and head stand posture of the body (169). Rai et al have studied the energy cost and ventilatory responses during Siddhasana, Virasana and
Matsyasana. There was a moderate rise in ventilation, oxygen consumption and oxygen pulse as compared to Savasana posture (159-161).

Brahmachari et al compared individual yogic postures in yoga proficient subjects and observed that the metabolic cost computed for Siddhasana, Paschimottanasana and Bhujangasana was 1.23, 1.45 and 2.62 kcal./minute respectively against the resting Savasana value of 1.06 kcal./min(27). He also measured energy cost in Padmasana, Kurmasana and Ustrasana in another study (29). They have indicated in another study that Asanas involving backward bending postures were having higher energy cost as compared to forward bending postures (28).

There are some interesting studies regarding the metabolic rate of yogis who claimed to be able to live in a closed chamber without food and water for long periods of time. B.K. Anand (2) showed that the subjects who were practicing yoga for a long time could reduce oxygen consumption and carbon dioxide production by 30%. He also observed in the same study that when yogis breathed air of low oxygen and high carbon dioxide concentration, they did not show any hyper-apnoea or tachycardia. Karambelkar in a similar study observed that oxygen consumption during stay in closed space was less in yogi than in non-yogi control. He also observed that a Yogi could tolerate higher level of carbon dioxide concentration as compared to non-yogi subjects (88). Anand et al in a study in an air tight compartment showed that as the time of confinement increased the subject consumed less oxygen and it was lesser in those practicing Pranayama than those who did not practice Pranayama (2). Bowman et al in 1997 observed that VO₂ max was increased by 11% following 6 weeks course of yoga training and he also observed that baroreflex sensitivity was increased in the same study (26). It is also reported that yoga practice for short term (10 weeks) could lower respiratory rate and increase forced vital capacity, FEV1, maximum breathing capacity and breath holding time (110). In another study it was reported that minute ventilation was reduced significantly after 90 days of yoga training (162). There is report that yogic practice for six months can decrease breathing frequency (251). Birkel et al observed that Hatha Yogic exercise can improve vital capacity of college students (22).

Miles observed that in Ujjayi type of Pranayamic breathing for 20 minutes, the rate of breathing was found to be as low as 1.26 per minute in comparison to 22 per minute in
resting condition while in Bhastrika type of breathing performed for more than 25 minutes it was for over 80 per minute (120). Bhole reported that during Kapalbhati type of breathing the breathing rate was high as 120-150 per minute (19). During experiments on usually practiced Hatha Yoga breathing technique like Ujjayi, Kapalbhati and Bhastrika it was found that these techniques utilized more oxygen in comparison to pre and post experimental values (120.166).

Study by Lepicovska et al showed that Hatha Yogic breathing exercise Jalandharabandha decreased the vagal reflex activity (100).

Raju et al observed the effect of Pranayama training at two different phase after the end of the first year and second year respectively. They found that oxygen consumption per unit work in sub maximal and maximal exercise test was reduced without increase in blood lactate level following Pranayama training (163).

Study by Telles et al had shown that resting basal oxygen consumption was increased by 37%, 18% and 24% in three groups of Practitioners underwent training in right nostril, left nostril and alternate nostril breathing Pranayama respectively. He also showed in the same study that volar galvanic skin resistance, an indicator of sympathetic nervous system activity, was reduced in the left nostril Pranayama group (249). He showed in another study oxygen consumption was increased by 17% during the practice of Anuloma Viloma Pranayama following the training in that Pranayama (250).

Joshi et al had shown that the practice of short term Pranayama can improve ventilatory functions (85).

Telles et al measured the oxygen consumption before and after the practice of Ujjayi type of very slow rate breathing in two groups practicing short term and long term breath holding during the practice. They found that oxygen consumption was increased by 52% and decreased by 19% in short term and long term breath hold groups (242).

Frostell et al studied the effect of spontaneous high frequency breathing on lung function. They observed that during high frequency breathing, breathing frequency was increased up to 232 breaths per minute with a tidal volume of 0.35 liter and a minute...
ventilation of 90 liters per minute. This high frequency breathing pattern is very closer to Yogic high frequency breathing known as Kapal Bhati (50).

Alteration in chemoreflex sensitivity following Yogic practice was studied by a number of investigators (179, 222, 252). Sovik elucidated the Yogic breathing on scientific basis (221).

3.5 Yoga and lipid status of the body

Yoga has got significant effect on the lipid status of the blood. It has been shown in one study that subjects practicing integrated course of yoga showed a regular fall in lipid parameters except high-density lipoprotein. The effect started from four weeks of yoga training and lasted for fourteen weeks of training (109).

3.6 Neurophysiological aspects of Yoga

Improvement in neurophysiological function by yogic exercise was shown by Madan Mohan et al (105). They observed that yogic practice for 12 weeks result in significant decrease in visual and auditory reaction time and significant increase in respiratory pressure, breath-holding time and handgrip strength. After two months of Hatha yoga training, there is an increase in parasympathetic activity and E.E.G. pattern was mostly a-type in the beginning during confinement experiment but later replaced by low voltage high frequency wave (20). Telles et al in 1993 reported that practicing yoga for three months may help to bring about a balance different autonomic functions as evidenced by change in volar galvanic skin response activity (239). Improvement in body flexibility and muscular efficiency to a standard task with a reduction in EMG build up by yogic exercise in middle aged man was observed by Ray et al (170-171). Salgar et al found that yogic exercise was more effective during low intensity exercise where as conventional exercise was more effective during high intensity exercise (184). Conversion of fast twitch fibres of the muscle into slow twitch following six weeks course of yoga training was reported by Balasubramaniam et al (8).

Study was conducted by Dhume et al to compare the relative strength of Dextroamphetamine and Yogic meditation on the task to balance on a balance board. They
revealed that the practice of meditation improved the task performance where as on the contrary Dextroamphetamine reduced it (40).

Study by Narayan et al revealed that the practice of Kundalini Yoga meditation reduced the muscle activity by 58% from the basal level after the end of the meditation as confirmed by the EMG study (138).

Study was conducted by Mohan to observe the effect of different nostril breathing on bilateral volar galvanic skin resistance, an indication of sympathetic activity. The sympathetic activity was low in left nostril breathing (Ida nadi- according to Yogic concept) (128). He showed in other studies that reversal of nostril dominance occur either reflexly on application of pressure to the axilla or due to change in posture (126-127). He also studied the effect of inspiratory and expiratory air flow on congestion and decongestion in the nasal cycle (125). Stancak et al studied the effect of 10-minute forced alternate nostril breathing on EEG topography. Their results revealed that frequency of β-wave mainly and α-wave partially increased during forced alternate nostril breathing. Their results also revealed that forced alternate nostril breathing has a balancing effect on the functional activity of the left and right hemispheres (227). The practice of Pranayama can be useful in the improvement of cognitive performance, spatial memory scores (80,139). There is also report that the practice of a particular breathing manoeuvre Santhi Kriya (a combined Yogic practice of breathing and relaxation) can increase the α-wave activity both in occipital and prefrontal areas of the brain. Increase in α-wave activity denotes an increase of calmness. This practice can also increase the oral temperature by three degree F and decreased the breathing rate significantly (194). Stancak et al observed the effect of practice of Kapal Bhati, a Yogic cleansing exercise on the EEG wave pattern and they suggested that slower frequencies of the EEG wave were increased, an indication of relaxation on a subjective level, immediately after the Kapal Bhati practice (225). There are several studies regarding the effect of Yogic practices on autonomic nervous system activity and EEG pattern (1a,42,66,131,180-181,267).

Neurological and behavioral aspects of transcendental meditation relevant to alcoholism were studied by Swinyard et al (236). A physiological effect of transcendental meditation was observed by Wallace (264). Spectral analysis of EEG during meditation was studied by Banquet (9).
Vempati *et al* observed that the practice of Yoga based guided relaxation technique reduced the sympathetic activity as judged by decrease in oxygen consumption, heart rate, skin conductance and increase in breath volume. There was also significant reduction and increase of low frequency and high frequency components of the heart rate variability spectrum respectively. These are all suggestive of reduced sympathetic activity (261).

Telles *et al* observed the autonomic nervous system changes during chanting of two syllables- one is meaningful and other is neutral. In both the cases respiratory rate and heart rate were reduced significantly. There was also significant reduction of skin resistance level while chanting meaningful word (238, 248). In other studies Telles *et al* recorded the auditory middle latency evoked potentials during the practice of meditation with the syllable 'OM' (243). Telles also observed the improvement in static motor performance following Yogic training in children (244).

Lazar *et al* tried to identify and characterize the different active regions of the brain by functional magnetic resonance imaging technique during the practice of meditation. They observed that the signals increased in the regions of dorsolateral prefrontal, parietal cortices, hippocampal/ parahippocampal, temporal lobe, pregenual anterior cingulated cortex, striatum and pre- and post central gyri during the meditation. Based on this observation they concluded that the practice of meditation activates neural structures those are associated with the attention process and control of autonomic nervous system activity (98).

Travis *et al* studied the physiological responses during transcendental meditation practice. They observed that this meditation is characterized by presence of apneustic breathing, increase in the frequency of peak EEG power. They also proposed one model in the same study called ‘Junctional point model’ which will be helpful to integrate pure consciousness with walking, dreaming or sleeping (254). Meti did an electrophysiological study of Pranayama and meditation in 1994 (119). Naga Venkatesh studied the P300 amplitude and antidepressant response to Sudarshan Kriya Yoga (135). The antidepressant efficacy of Sudarshan Kriya Yoga was also studied in another study (79).

Yogic training was found to increase the motor speed for repetitive finger movement (38). Yogic training was also found to increase critical flicker fusion frequency- a study by Vani *et al* (259).
It was observed by Raghuraj et al that muscle power; dexterity skill and visual perception were improved following Yogic training (157). Gopal et al studied the effect of Yogasana on muscle tone. In the same study he also observed the cardiorespiratory adjustment associated with Yogic exercises (62).

3.7 Yoga and Body fat percentage

The usefulness of yoga in reduction of body fat was shown by Bera et al in 1993. They observed that the sum of the fat skin fold and sum of body circumferences reduced significantly following yoga training (16). Ray et al also showed significant reduction of fat percentage after six months of Yoga training (175).

3.8 Yoga and altitude acclimatization

Selvamurthy et al reported that the practice of yogic exercises facilitated acclimatization to high altitude and cold stress in army subjects (208,210). Hatha-Yoga is becoming increasingly popular in western countries as a method for coping with stress.

3.9 Yoga and psychological aspects

Study by Schell et al had shown that young female volunteers who were practicing yoga for certain days had relatively improved psychological parameters and decreased heart rate (196). Study by Wood had shown that practice of Pranayama produced a significant increase in perceptions of mental and physical energy and feelings of alertness and enthusiasm (272). Study by La Forge had shown that the practice of Mind-body exercise such as Chinese Tai’Chi and Indian Yoga along with existing health promotion and cardiac rehabilitation service can improve mental as well as physical functions significantly. Personal stress management skills also improve as a result of this Mind-body fitness training (96). Study was conducted by various investigators on the psychophysiological aspects of yoga meditation (35,101,273). Meditation is helpful in the reduction of stress (182). Ray et al studied the effect of Yogic exercises on physical and mental health of young fellowship course trainees, results revealed improvement in physical and mental health (172). Physiological changes during Yoga meditation was studied by Elson et al (43). As a psychoterapeutic measures meditation has been applied by Smith et al (219).
3.10 Yoga and Endocrinological aspects

Jevning et al studied the adrenocortical activity during the practice of transcendental meditation. Their study revealed that the practice of transcendental meditation is associated with psychophysiologic responses that acutely inhibit pituitary adrenal activity (81). They studied the effect of transcendental meditation, adrenocortical activity and its implication for stress in another study (82). Gode et al observed that urinary excretion of testosterone was increased following a Yogic training in normal young volunteers (60). Schmidt et al observed the changes in cardiovascular risk factors and alteration in hormone level following a comprehensive Kriya Yoga training for three months and vegetarian nutrition (198).

Yogic exercise is associated with decreased in serum cortisol level and activation of α-wave (87). Tooley et al found that meditation increases the level of plasma melatonin in the night time acutely (253).

3.11 Yoga and Therapeutic aspects

Ito et al studied the effect of respiratory muscle stretch gymnastics and diaphragmatic breathing on the respiratory pattern in patients with chronic obstructive pulmonary disease. They suggested that after respiratory muscle stretch gymnastics $V_E$, $VCO_2$, RER, end tidal $O_2$ fraction, end tidal $CO_2$ fraction and tidal diaphragmatic volume improved and in diaphragmatic breathing post-hyperventilation hypoxemia occur (75).

Dolk et al studied the effect of Yoga in patients with severe defecation difficulties known as puborectalis paradox. They underwent training in Yogic techniques of relaxation of pelvic muscles. Only One patient out of nine patients improved clinically (41).

Study on the effect of relaxation therapy in mild hypertensive subjects was done by Van Montfrans et al. Relaxation therapy included muscle relaxation and Yoga exercises. They observed that blood pressure was reduced by 2 mmHg after one year of Yogic training programme (258). The effect of Yogic exercise in the management of hypertension was studied by a number of investigators (11,23,25,36,49, 147,148,150-151,154,232). A study by Selvamurthy et al had shown that sluggish baroreflex mechanism in essential hypertension could be reactivated following the practice of three weeks course of Yogic training (210). Datey et al had also shown that the practice of Shavasana and Yogic exercise could be helpful in the management of hypertension (39).
The practice of meditation and Yogic relaxation technique in the reduction of blood pressure were studied by various investigators (10,14-15,37). French et al studied the therapeutic application of relaxation method (48).

Yoga has got therapeutic potential in the management of Bronchial asthma. Studies conducted by various investigators revealed that the practice of certain breathing manoeuvres and Yogic exercises are beneficial for Bronchial asthma (6,46,78,91,106,136-137,177,193,214-216, 260,271).

Yogic practice may be useful in the management of epilepsy. Stress is considered as an important factor for precipitating epileptic seizure. Earlier studies had shown that Yoga could be useful for reduction of stress and induction of relaxation. Several studies were conducted to observe the effect of Yogic training on epilepsy (165,144-146,274).

Gallois studied the neurophysiologic and respiratory changes during the practice of transcendental meditation, a Yogic relaxation technique. He concluded that this deep relaxation technique may play an important role in the treatment of psychosomatic illness (52).

Ornish et al studied the reversal of coronary artery disease after introducing the Yogic intervention programme (142). Yogic practice has been found to be valuable in the prevention of adverse outcomes of coronary disease (143). There is also report that Yogic intervention along with traditional therapies is beneficial for prostate cancer (33). It was studied that Yoga base intervention are very useful for carpal-tunnel syndrome (58).

Most of these works have concentrated on a particular physiological system. Literature is still scanty in the area where different physiological systems have been considered simultaneously during the actual practice.

In the present study certain aspects of change in cardiovascular, respiratory system during the practice of Surya Namaskar have been observed at different periods of Yogic training on a group of soldiers and values are being compared with those of advanced Yoga practitioners known as yoga Proficient (they are basically yoga instructors who have been practicing yogic exercises at least for last four years).