Research Paper
Impact Factor: 3.567
Peer Reviewed Journal

IJMDRR
E- ISSN –2395-1885
ISSN -2395-1877

STUDY ON THE EFFECT OF YOGASANS, PRANAYAM AND MEDITATION PRACTICES ON HYPERTENSION

Dr Isha Sagar
Post Doctoral Research Scholar, Department of Physical Education P.U. Chandigarh.

Abstract
Background*: Hypertension is the most common cardiovascular disease affecting more than one billion people worldwide. Yogic exercises (Asana, Pranayama and Meditation) have beneficial effects on hypertension.* ***Aims &Objectives****: The aim of present study was to evaluate the effects of yogasana, pranayama, and meditation as an adjunct to pharmacotherapeutic treatment in hypertension stage-1(Systolic Blood Pressure 140–159 mmHg and Diastolic Blood Pressure 90–99 mmHg) and Hypertension stage-2 (Systolic Blood Pressure ≥160 mmHg and Diastolic Blood Pressure ≥100mmHg) patients.* ***Materials & Methods****: The study was conducted on 50 hypertensive patients aged 40-50 years, who were on salt reduction and antihypertensive drugs. They were randomized into two groups: control group (n=25; age 44.64±3.69years) and Experimental group (n=25; age 45±3.55 years). The Experimental group practiced yoga for 45 min, 5 day/week for 3 months. The control group did not practice any type of yogic exercises or relaxation techniques. Systolic blood pressure (mmHg), diastolic blood pressure (mmHg), and pulse rate (beats per minutes) of all patients were assessed at day 1stand monthly for 3 months. The data were analyzed using paired and unpaired „t' test by SPSS software v 18.* ***Results****: In the present study, there were significant reduction in mean values of systolic blood pressure (121.12±8.18), diastolic blood pressure (77.04±3.35), and pulse rate (69.52±2.84) after 12 weeks of yogic practices in study group as compared to control group in whom mean values of the systolicblood pressure (138.16±12.98), diastolic blood pressure (94.24±12.32), and pulse rate (98±3.13) was note d after 12weeks. From the present study it was observed that a significant reduction in the systolic blood pressure, diastolic blood pressure and pulse rate occurs in subjects practicing yoga (p<0.001). The results of present study indicated that practice yoga has beneficial effect on reduction of high blood pressure & dose of anti-hypertensive drug also.*
Conclusion: *Yoga and meditation should be recommended as an adjuvant therapy along with medication (anti-hypertensive drugs) to tilt the autonomic balance to parasympathetic dominance to get relieved from hypertensive symptoms.*

Key Words: Yogic Exercise, Hypertension, Blood Pressure and Pulse Rate.

INTRODUCTION

Word Yoga is derived from a Sanskrit word which means "union." The goal of classical yoga (hatha yoga) is tobring self-transcendence, or enlightenment, through physical, mental and spiritual health through the observation of controlled breathing (pranayama), prescribed postures (asanas), and meditation (dhyana). Yoga and meditation combined with a low-fat diet and group support could significantly reduce the blockage of coronary arteries. Otherstudies have shown yoga's benefit in reducing stress-related problems such as high blood pressure and cholesterol. Yoga is an auxiliary mean which acts synergistically with the conventional medicine. The yogic postures improvevital organ functioning by influencing the mind without giving fatigue to muscles. Yoga and relaxation techniqueskeep the body fit and strong plus gives a feeling of well being (Chakrabarty et al., 1984).

Yoga helps in increasing oxygen supply to the brain (Luskin et al., 1998). It plays an important role in decreasing impact of various risk factors in many cardiovascular diseases (Makwana et al., 1988). Balasubramanian & Pansare (1991) have reported that yoga training produces a significant decrease in anaerobic power. Bera & ajapurkar (1993) have reported significant improvement in cardiovascular endurance and anaerobic power as a result of yoga training. All over theworld scientists have extensively studied Yoga and claimed that it increases longevity of life (Iyengar, 1968), hastherapeutic (Datey et al., 1969) and rehabilitative effects (Lakshmikanthan et al., 1979). Several investigations describe that yoga have beneficial effects on the functioning of the muscular, cardiovascular, respiratory, gastrointestinal & other systems, so that yogic exercises are preferred to other form of exercise.Yoga is useful to patients of heart diseases and hypertension. It affects hypothalamus & brings about decreases inthe systolic & diastolic BP through its influence on vasomotor center, which leads to reduction in sympathetic tone& peripheral resistance. Yoga reduces anxiety, promotes well-being, and improves quality of life. Its safety profiles excellent. Its use as a complementary therapeutic regimen under medical supervision is appropriate and could be worth considering. Medical science tries to achieve an optimum physical and mental health of the individual through preventive, curative and promotive means. However, for a long time medical professionals have laid much emphasis on the curative aspect and only relatively recently the preventive aspect is also being emphasized whereas in yogic practice

the emphasis is mainly on the promotive aspect, although some yogic methods are prescribed for curative purposes as well (Mallick, 2001). A wide variety of common diseases such as coronary heart disease, hypertension and diabetes mellitus are now being attributed to a faulty lifestyle. Yoga is probably the best lifestyle ever devised in the history of mankind. It is a simple, means of giving non-judgmental way and view of life upon which people across culture and across countries has stumbled from time to time for centuries. This peace of universal wisdom, which has been discovered and rediscovered several times in history as the "Ultimate Prescription for Health peace and joy "has been organized into a systematic process in yoga (Bijlani, 2004). After the favorable effects of a yogic lifestyle on coronary heart disease demonstrated by Ornish et al., (1990) and his colleagues, yoga is finding increasing acceptance as a non-pharmacological intervention for the prevention and treatment of several diseases.

Hypertension is a common disorder affecting 15% of adult population in India, Modern medicines can treat hypertension in long run but they have side effects (Saraswati, 1978; Sharma, 1994; Maeie, 1993; Mishra, 1993). Soduring last few decades, yoga has got incorporated into modern medicine itself.

Definition for Stage-1 hypertension and Stage – 2 hypertension based on systolic and diastolic blood pressure
A recent classification recommends blood pressure criteria for defining normal blood pressure, pre-hypertension, hypertension (stages I and II), and isolated systolic hypertension, which is a common occurrence among the elderly.

In children generally hypertension defined as systolic and/or diastolic blood pressure consistently >95th percentile for age, sex, and height. Blood pressures between the 90th and 95th percentiles are considered pre-hypertensive are an indication for lifestyle interventions (Dan et al., 2011).

Blood Pressure Classification	Systolic, mmHg	Diastolic, mmHg
Normal	<120	*and* <80
Pre-hypertension	120–139	*or* 80–89
Stage 1 hypertension	140–159	*or* 90–99
Stage 2 hypertension	>160	*or* >100
Isolated systolic hypertension	< 140	*and <90*

Materials and Methods
The Present study was Randomized Quincy control interventional study. The study was conducted on 50 hypertensive patients aged 40-50 yrs of both sexes, who were on salt reduction and antihypertensive drugs. They were randomized into two groups; control group (n=25; age 44.64±3.69years) and Experimental group (n=25; age 45±3.55years). Experimental group and control group randomly selected from the Gandhi Samarak Bhawan Yoga and Naturopathy centre Chandigarh. Experimental group practiced "Yogic exercises" i.e., Asanas" (postural techniques), Pranayama (breathing practice) and meditation, under proper guidance of the yoga instructor for 45 min, 5 days/week for 3month in the Gandhi Samarak Bhawan, Yoga and Naturopathy centre, Chandigarh. The control group did not practice any type ofyogic exercises, relaxation techniques or physical exercise.

Selection criteria for both the groups
Inclusion criteria:
1. pre-diagnosed hypertension stage-1 and Hypertension stage-2.
2. Subjects between 40-50yrs.
3. Subjects giving informed and written consent.

Exclusion criteria
1. Subject with any other pre-diagnosed cardiac disease.
2. Subjects with any major pulmonary, renal, endocrinal and neurological diseases.

Parameters measured
Pulse rate, systolic and diastolic blood pressure were recorded before the study as non-invasive cardiac parameters.

The pulse was recorded after a rest for 30 minutes in right radial artery by palpatory method. A standard MERCURY SPHYGMOMANOMETER was used to record resting blood pressure in left arm by both palpatory. (Radial Artery) and auscultatory method (Brachial Artery).

On taking detail history, all subjects were non alcoholic, non-smokers, not taking any drug other than antihypertensive medicine and were having similar dietary habits, physical and mental activities in working atmosphere. Prior to the yoga training readings were taken and the procedure was explained, history of fainting attack was asked, ill-fitting dentures were removed and then the subjects were made to practice yogi exercise. Twelve week Yoga Training was given to the subjects in Gandhi Samarak Bhawan, Yoga and Naturopathy Centre, Chandigarh, in the morning hrs for 45min at 8:00 A.M to 8:45 A.M. Subjects were advised to come empty stomach for YOGA Training.

This YOGA Training included YOGA ASNAS (PAWANMUKTASANA, ARDHALASANA, VIPARITAKARANI, MAKRASANA, ARDSHALABHASANA VAKRASANA, VAJARASANA and BHUJANGASANA), PRANAYAMAS (NADI SHODHAN, BHRAMARI, OM CHANTING) AND MEDITATION.

The parameters were measured on 1st day and every month for 3 months of the study in both Experimental and control group. The experimental group was asked to take yoga training along with anti-hypertensive drug treatment. The schedule of yoga training was explained to all participants and after three days practice session, the actual practice of yoga was introduced. Control group were taking medicine under similar conditions of the study. The Experimental pharmacotherapy toboth the groups was continued and any changes in doses were recorded during the study.

Statistical analysis

Outcome Variables:

Pulse rate, Systolic BP & Diastolic BP before & after intervention in the Experimental group.Pulse rate, Systolic BP & Diastolic BP before & after intervention in the Control group.

Outcome analysis:

Unpaired‟ Test to find out change in both the groups (Experimental & control).Paired„t‟ Test to find out change before & after in both the groups (Experimental & control).Data thus collected were submitted to Microsoft excel 2007 worksheet in the form of master chart & were classified& presented with help of Microsoft excel 2007 worksheet. The qualitative data were analyzed in the form of rates,ratio, proportion & quantitative data will be analyzed in the form of mean with standard deviation.The data weretested for normal distribution. The data of general characteristics were analyzed using paired and unpaired student ‚t‟test. A p-value of <0.001 was considered statistically highly significant, p-value of <0.05 was considered significantand a p-value of >0.05 was considered not significant.

Results

Table 1: Shows the comparison of Mean + SD of cardiac parameters on various day of Experimental & control group

Variables	Groups	1st Day	4th Week	8th Week	12th Week	In intra-group comparisons		
		Median (inter quartile range)				p-1	p-2	p-3
SBP (mmHg)	Experimental	158.24±15.61	142.32±9.29	133.24±9.55	121.12±8.18	>0.001 (HS)	>0.001 (HS)	>0.001 (HS)
	Control	160.16±14.56	153.64±13.60	148.24±14.50	138.16±12.98	0.021 (NS)	0.006 (S)	0.002 (S)
DBP (mmHg)	Experimental	102.24±4.42	94.32±4.75	85.84±2.64	77.04±3.35	>0.001 (HS)	>0.001 (HS)	>0.001 (HS)
	Control	104.32±13.23	99.2±7.34	96.08±14.44	94.24±12.32	0.097 (NS)	0.039 (S)	0.006 (S)
Pulse rate (beat per minute)	Experimental	98.24±5.06	83.04±5.68	78.56±3.37	69.52±2.84	>0.001 (HS)	>0.001 (HS)	>0.001 (HS)
	Control	102.88±13.30	100.48±12.06	98.08±12.79	98±12.96	0.212 (NS)	0.011 (S)	0.007 (S)

Table exhibits Mean ± SD of cardiac parameters on Day-1, at 4th week, at 8th week and at 12th week of intervention(study and control).PR= pulse rate, SBP=systolic blood pressure, DBP=diastolic blood pressure; p1= Day-1st vs 4thweek, p2= Day-1st vs 8th week, p3= Day-1st vs 12th week. p<0.001= statistical highly significance. (HS), p<0.05 =statistical significance. (S), p>0.05 = no significant differences (NS).The Experimental group showed significant reduction in resting PR, SBP, and

DBP after 4 weeks of yoga practice as compared to baseline recording and further reduction after 8 and 12 weeks of yoga practice and all these variables were significantly reduced as compared to control group. No such significant changes were found in the control group over the study period within-group comparison as showed in given table and figures. Dose of the antihypertensive drugs was reduced in most of the patients of study group. In study group the blood pressure of four subjects dropped below baseline value even with reduced doses of anti–hypertensive, so they were advised to stop the medicine under supervision of physician. In control group there is no significant reduction in the blood pressure and pulse rate which may be due to of their faulty lifestyle or they may not have followed strictly the dose schedule.

Figure 1: Shows comparison of mean values of systolic blood pressure in Experimental study and control group on day 1,4th week, 8th week and 12th week

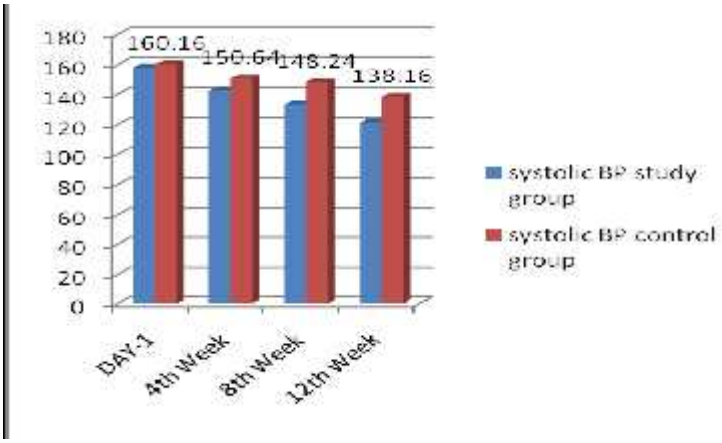


Figure 2: Shows comparison of mean values of diastolic blood Pressure in Experimental and control group on day 1,4th week, 8th Week and 12th week

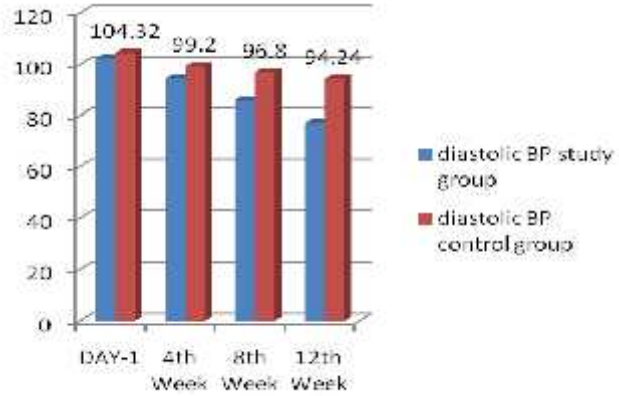
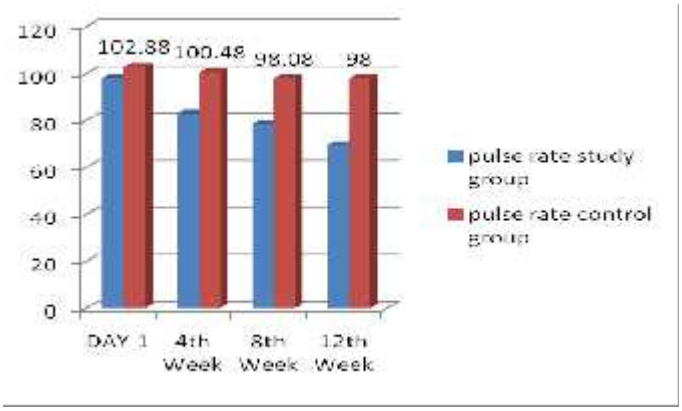


Figure 3: Shows comparison of mean values of pulse rate in Experimental and control Group on day 1,4th week, 8th week and 12th week.



The paired„t" test results showed significant reductions in pulse rate, blood pressures after yoga intervention in experimental group. There was little change in control group after 3 months of yoga practice.

Discussion

Hypertension is a multifactorial disease in which arterial pressure is persistently high without an identifiable cause.The pathogenesis of hypertension is not fully understood. Blood pressure is mainly dependant on cardiac output andtotal peripheral resistance. The possible mechanism is believed to be sympathetic nervous system over activity and consequent increase in peripheral vascular resistance. In addition, direct pressure effect by the sympathetic nervous system and catecholamine released from the adrenal medulla may also be involved. Hypertrophy of systemic arterioles may represent an adaptive response to chronically elevated blood pressure and may perpetuate systemic hypertension. Inappropriately high sympathetic nervous outflow from central nervous system is also believed to bean important component in the path physiology of acute and chronic hypertension which in turn increases cardiac output and peripheral resistance. Regulation of blood pressure is normally an involuntary process controlled by sympathetic nervous system and hypothalamus. Stimulation of posterior and lateral parts of hypothalamus activates the sympathetic nervous system. Repeated sympathetic stimulation via hypothalamus has been shown to produce sustained systemic hypertension. The cerebral cortex can be trained to influence the blood pressure. This effect is likely to be mediated through the hypothalamus. Hypothalamus is also closely related to limbic system which plays an important role in emotional and instinctual behavior. Since many manifestations of emotional changes like anger involve sympathetic responses, all these parts of the brain are likely to have some effect on the blood pressure. Stress too is likely to influence blood pressure through these pathways. Since, cerebral cortex is necessary for all voluntary actions, voluntary reduction of stress may be achieved by training the cerebral cortex In the present study, the mean values of pulse rate, systolic blood pressure and diastolic blood pressure were low in Experimental group than in control group. It is well known that yoga training decreases PR and BP. Environmental conditions and variety of behavioral factors such as stress, anxiety, affective and attitudinal dispositions of the individual influence the cardiovascular responses. Yogic exercise involves physical, mental and spiritual task in comprehensive manner. It also brings about the behavioral changes. Yoga in long duration affects hypothalamus and brings about decrease in the systolic and diastolic BP through its influence on vasomotor centre, which leads to reduction in sympathetic tone and peripheral resistance (Khanam et al., 1996). Yoga involves pranayama i.e. voluntary alteration of the breathing pattern and scientists working on yoga found increased parasympathetic tone inyoga practitioners especially trained in pranayama (Wenger et al., 1961).

Yoga training for two months resulted in a significant decrease in basal PR and BP. A decrease in DBP after yogatraining has also been reported by Ray et al., (1986) who attributed this to a reduction in sympathetic activity. Bera&Rajapurkar (1993) have reported that yoga training results in significant improvement in cardiovascular endurance and anaerobic threshold. This is consistent with the findings of Muralidhara&Ranganathan (1982) that yoga training improves physical efficiency as indicated by significant increase in cardiac recovery index measured by Harvard step test. Our findings of decrease in BP, and PR after yoga training are consistent with the findings ofRay et al., (1986) that yoga training increases muscular endurance, delays onset of fatigue and enables one to perform work at lesser VO2 max. An exaggerated cardiovascular reactivity to the stressors is known to be a risk factor for cardiovascular diseases whereas reduced reactivity is an indicator of fitness.

The result revealed that both Yoga intervention and drugs treatment helped. However, only mild and moderate casesof hypertension may be controlled easily without drugs. Severe case may need pharmacological intervention. Theavailable drugs include beta-blockers, sympatholytics calcium channel blockers and ACE inhibitors (Somani, 1996).Several previous investigators have also observed that Yoga lowers systolic pressure (Patel& North,1975; Patel,1975; Sunder et al., 1984).In the case of stress related Hypertension, Yoga might modify the states of anxiety(Patel,1975), thus reducing hypertension.
In the present study, yoga practice included combined practice of easy asana, meditation and pranayama. The decrease in BP and PR may have been because of combined effect of components of yoga. Similar effect of decreasein SBP and DBP was reported in mild to moderate hypertensive patients (Murugesan et al., 2000; Patel et al., 1981).

In both these studies, patients were not on antihypertensive drugs and reduction in BP was found after long time ofyogic practices. In the present study patients were treated with antihypertensive drugs along with yoga and theyshowed decrease in BP even after shorter period of yoga practices. It is important to note that drugs may havemimicry action for decreasing BP by yogic practices because similar effect was observed in patients treated withdrugs in an earlier study (Patel, 1975). Other studies (Laxmikanthan et al., 1979; Vijayalakshmi et al., 2004) alsofound reduction in BP after yogic practices. In these studies patients practiced meditation, pranayama, easy asana sand also few difficult asanas like Chakrasana, Halasana, and Sarbhangasana but in present study patients practicedmeditation, pranayama and few easy asanas but not the difficult asanas.

Thus the present study showed thatcombined practice of even easy asanas, meditation, and pranayama for shorter duration is effective in reducing BP in hypertensive patients. The duration as short as two weeks was sufficient to detect significant desirable physiological effects. Specifically the yogic posture influences various physiological organs in the body rather than producing simple skeletal muscle action (Udupa, 1971). A combined practice of several important asanas has shown considerable improvement in cardio-respiratory functions, adrenocortical functions and a number of metabolic correlations in addition to remarkable psychological and neurophysilogical improvements (Udupa& Singh, 1972). Itis one of the possible mechanisms for reduction of BP in hypertensive patients. The Shavasana, a relaxation exercise probably influences the hypothalamus through the continuous feedback of slow rhythmic proprioceptive and enter receptive impulses (Datey et al., 1969) that can establish a psycho-physiological relaxation and reduce the physiological stress in shorter time (Bera et al., 1998) It is known that stress can cause hypertension through repeated blood pressure elevations as well as by stimulation of the nervous system to produce large amounts of vasoconstrictor hormones that increase blood pressure (Kulkarni et al., 1998). Reduction in stress after yogic practices might be other possible mechanism for reduction of resting PR and BP in the present study. It is reported that yogic practices that appear to exert neuro-physiological stability is evident from lowered level of cholinesterase and catecholamine's (Udupa et al., 1975). It might lead to reduction in BP because lowered level of cholinesterase and catecholamines cause reduction in sympathetic activation and increase in parasympathetic activity. We also found increase in parasympathetic activity in our study after yoga practice. Regarding BP changes in an earlier studyit has been reported that the total peripheral resistance and average ambulatory DBP decreased significantly during meditation (Barnes et al., 1999). The decrease in vasoconstrictor tone during meditation might be the hemodynamic mechanism responsible for reduction in DBP in the present study.

Conclusion

We conclude that yogic practices combined with anti-hypertensive drugs were found effective in reducing BP & PR in resting condition and during stimulus induced conditions as well in mild to moderate hypertension. It reduced the requirement of the dose of antihypertensive drugs in majority of the hypertensive patients. Specifically it was found to affect cardiovascular autonomic regulation and tends to normalize it.

References

1. Balasubramanian B &Pansare MS (1991).Effect of yoga on aerobic and anaerobic power osssf muscles.*IndianJournal of Physiology and Pharmacology*, 35 281-282.
2. Barnes VA, Treiber FA, Turner JR, Davis H & Strong WB (1999).Acute effects of transcendental meditation onhemodynamic functioning in middle-aged adults.*Psychosomatic Medicine*, 61(4) 525-531.
3. Bera TK &Rajapurkar MV (1993).Body composition, cardiovascular endurance and anaerobic power of yogicpractitioner.*Indian Journal of Physiology and Pharmacology*, 37(3) 225-228.
4. Bera TK, Gore MM & Oak JP (1998). Recovery from stress in two different postures and in Shavasana - A yogicrelaxation posture.*Indian Journal of Physiology and Pharmacology*, 42(4) 473-477.
5. Bijlani RL (2004). Text book of Medical physiology. 3rd Edition, Published by Jitender P VIJ *JaypeeBrothersMedical Publishers (P) Ltd*., 871-906.
6. Brand RJ & Gould KL (1990). Can life style changes reverse coronary heart disease? *Lancet*, 336 129-133.
7. Chakrabarty BK, Ghosh HN &Sahana SN (1984).Human Physiology. 2nd Edition, The New Book Stall,Calcutta, India.
8. Dan Longo, Anthony Fauci, Dennis Kasper, Stephen Hauser, J. Jameson & Joseph Loscalzo (2011). Harrison'sPrinciples of Internal Medicine, 18th Edition, 2047.
9. Datey KK, Deshmukh SN, Dalvi CP &Vinekar SL (1969). "Shavasana" and Yogic exercise in the managementof hypertension. Angiology Research Foundation, Las Vegas 325-333.
10. Iyengar BKS (1968).Light on Yoga. George Allen and Unwin Ltd, London 243-245.
11. Khanam AA, Sachdeva V, Gulera R & Deepak KK (1996).Study of pulmonary and autonomic functions ofAsthma patients after Yoga training.*Indian Journal of Physiology and Pharmacology*, 40(1) 318-321.
12. Kulkarni S, O.Earrell I, Erasi M &Kochar MS (1998).Stress and hypertension.*Wisconsin Medical Journal*,97(11) 34-38.
13. Lakshmikanthan C, Alagesan R &Thanikanchalam S (1979). Long term effects of yoga on hypertension and/orcoronary artery disease. *Journal of the Association of Physicians of India*, 27 1055-1058.
14. Luskin FM, Newell KA, Griffith M, Holmes M, Telles S, Marvasti FF, Pelletier KR & Haskell WL (1998).AReview of mind-body therapies in the treatment of cardiovascular disease part-I Implications for the elderly.*Alternative therapies in health and Medicine (United States)*, 4 46-61.

15. Maeie SV (1993). Hypertension response among normotensive patient during stress test: An early marker for future Hypertension. *Indian Heart Journal,* 45(4) 298-301.
16. Makwana K, Khirwadkar N& Gupta HC (1988).Effect of short term yoga practice on ventilatory function test.*Indian Journal of Physiology and Pharmacology,* 32(3) 202-208.
17. Mallick HN (2001). Review of Prof. B. K. Anand's Scientific Study.*Indian Journal of Physiology andPharmacology*, 45(3) 269-295.
18. Mishra TK (1993). Comparative trial of enalapril vs. felodipine on LV mass reduction in essential Hypertension.*Indian Heart Journal,* 44(4) 322-325.
19. Muralidhara DV &Ranganathan KV (1982).Effect of yoga practice on cardiac recovery index.*Indian Journal ofPhysiology and Pharmacology,* 26(4)279–283.
20. Murugesan R, Govindrajulu N &Bera TK (2000).Effect of selected yogic practices on the anagement ofhypertension.*Indian Journal of Physiology and Pharmacology,* 44(2) 207-210.
21. Ornish D, Brown SE, Scherwitz LW, Billings JH, Amrstrong WT, Ports TA, McLanahan SM, Kirkeeide RL,
22. Patel C & North WRS (1975).Randomized control trial of yoga and biofeedback in management of hypertension .*Lancet,* 19 93.
23. Patel C (1975). 12-month follow-up of yoga and biofeedback in the management of hypertension. *Lancet,* 11(1) 62-64.
24. Patel C (1975). TM and hypertension. *Lancet,* 1 539.
25. Patel C, Marmot MG & Terry DJ (1981).Controlled trail of biofeedback-aided behavioural methods in reducingmild hypertension. *British Medical Journal,* 282(6281) 2005-2008.
26. Ray US, Hegde KS &Selvamurthy W (1986). Improvement in muscular efficiency as related to a standard taskafter yogic exercises in middle aged men. *Indian Journal of Medical Research,* 83 343-348.
27. Ray US, Mukhopadhyaya S, Purkayastha SS, Asnani V, Tomer OS, Prashad R, Thakur L &Selvamurthy W(2001). Effect of exercises on physical and mental health of young fellowship course trainees.*Indian Journal ofPhysiology and Pharmacology,* 45(1) 37-53.
28. Saraswati S (1978). The effect of yoga on hypertension.Bihar School of yoga, Monghyr.
29. Sharma S (1994). Tran luminal renal angioplasty in the treatment of endovascular hypertension.*Indian HeartJournal,* 46(5) 414-417.
30. Somani SM (1996). Pharmacology in exercise and sports. CRC Press, New York.
31. Sunder S, Agrawal SK, Singh VP, Bhattacharyya SK, Udupa KN &Vaish SK (1984). Role of yoga in management of essential hypertension.*ActaCardiologica,* 39 203-206.
32. Udupa KN & Singh RH (1972).Scientific basis of yoga. Journal of the American Medical Association, 220 1365.
33. Udupa KN, Singh RH &Settiwar RM (1975). Physiological and Biochemical studies on the effect of yoga andcertain other exercises.*Indian Journal of Medical Research,* 63(4) 620-624.
34. Udupa KN, Singh RH &Settuwar RM (1971). Studies on physiological, endocrine and metabolic response to thepractice of yoga in young normal volunteers.*Indian Journal of Medical Research,* 6(3) 344-353.
35. Vijayalakshmi P, Madanmohan, Bhavanani AB, Patil A&Babu K (2004).Modulation of stress induced byisometric handgrip test in hypertensive patients following yogic relaxation training.*Indian Journal of Physiologyand Pharmacology,* 48(1) 59-64.
36. Wenger MA, Bagchi BK &Anand BK (1961).Experimental in India on voluntary controls of the heart and pulse. *Circulation,* 24 1319-1325