RESEARCH STUDIES ON YOGA THAT CAN PROVIDE A SCIENTIFIC BASIS OF USING YOGA IN PREVENTION AND MANAGEMENT OF HYPERTENSION

Indian J Physiol Pharmacol. 2004 Jan ;48(1):59-64.

MODULATION OF STRESS INDUCED BY ISOMETRIC HANDGRIP TEST IN HYPERTENSIVE PATIENTS FOLLOWING YOGIC RELAXATION TRAINING.

Vijayalakshmi P, Madanmohan, Bhavanani AB, Patil A, Babu K.

13 essential hypertensive patients aged 41 to 60 years were given yoga training for 60 min daily, Monday through Saturday, for a total duration of 4 weeks. Blood pressure and heart rate (HR) were measured with non-invasive semi-automatic blood pressure monitor. Measurements were recorded before the training and at weekly intervals during the 4 week training period. Results of our study show a significant ($P<0.001$) reduction in resting HR and rate-pressure-product (RPP) after 2 weeks of yoga training. Systolic pressure (SP), diastolic pressure (DP) ($P<0.001$) and mean pressure (MP) ($P<0.05$) showed a significant reduction at 3 weeks of training period. After 4 weeks of training, there was further fall in SP, DP, pulse pressure (PP) ($P<0.05$), MP ($P<0.001$), HR and RPP. Isometric handgrip test before yoga training produced a significant rise in SP and MP and insignificant rise in DP, HR and RPP. After yoga training, there was a significant rise in all these parameters. Our results show that yoga training optimises the sympathetic response to stressful stimuli like isometric handgrip test and restores the autonomic regulatory reflex mechanisms in hypertensive patients.

Int J Cardiol. 2006 Aug 28;111(3):450-2.

EFFECT OF DEEP BREATHING AT SIX BREATHS PER MINUTE ON THE FREQUENCY OF PREMATURE VENTRICULAR COMPLEXES.

Prakash ES, Ravindra PN, Madanmohan, Anilkumar R, Balachander J.

Although the effect of reflex increase in vagal tone on the frequency of premature ventricular complexes (PVC) is known, the effect of timed deep breathing on the frequency of PVC has not been reported. We serendipitously discovered that deep breathing at six breaths per minute abolished PVC in an 18-year-old female with frequent PVC, anxiety, and palpitations. In five of a series of 10 consecutive patients with frequent (> or = 10/min) unifocal PVC, deep breathing at 6 breaths/min reduced the frequency of PVC by at least 50%. This is possibly due to increased vagal modulation of sinoatrial and atrioventricular node. However, factors predicting the response to deep breathing, and the mechanisms involved need to be studied in a larger number of patients.

Indian J Physiol Pharmacol. 2003 Jan;47(1):27-33.

EFFECT OF PRANAYAM TRAINING ON CARDIAC FUNCTION IN NORMAL YOUNG VOLUNTEERS.

Udupa K, Madanmohan, Bhavanani AB, Vijayalakshmi P, Krishnamurthy N.

Systolic time intervals (STI) are non-invasive and sensitive tests for measuring the ventricular performance. It has been reported that practice of pranayam modulates cardiac autonomic status and improves cardio-respiratory functions. Keeping this in view, the present study was designed to determine whether pranayam training has any effect on ventricular performance as measured by STI and cardiac autonomic function tests (AFT). Twenty four school children were randomly divided into two groups of twelve each. Group I (pranayam group) subjects were given training in nadishuddhi, mukh-bhastrika, pranav and savitri pranayams and practiced the same for 20 minutes daily for a duration of 3 months. Group II (control group) subjects were not given any pranayam training. STI (QS2, LVET and PEP) and AFT (RRIV and QT/QS2) were measured in both the groups at the beginning and again at the end of three months study period. Pranayam training produced an increase in RRIV and a decrease in QT/QS2, suggesting an enhanced parasympathetic and blunted sympathetic activity respectively. QS2, PEP and PEP/LVET increased significantly, whereas

LVET was reduced significantly in pranayam group. In contrast, the changes in STI and AFT were much less marked in the control group. Our study shows that three months of pranayam training modulates ventricular performance by increasing parasympathetic activity and decreasing sympathetic activity. Further studies on a larger sample size may illustrate the underlying mechanism(s) involved in this alteration.

Indian J Physiol Pharmacol. 2005 Jul-Sep;49(3):313-8.

EFFECT OF SLOW AND FAST PRANAYAMS ON REACTION TIME AND CARDIORESPIRATORY VARIABLES.

Madanmohan, Udupa K, Bhavanani AB, Vijayalakshmi P, Surendiran A.

We planned to undertake a comparative study of the effect of short term (three weeks) training in savitri (slow breathing) and bhastrika (fast breathing) pranayams on respiratory pressures and endurance, reaction time, blood pressure, heart rate, rate-pressure product and double product. Thirty student volunteers were divided into two groups of fifteen each. Group I was given training in savitri pranayam that involves slow, rhythmic, and deep breathing. Group II was given training in bhastrika pranayam, which is bellows-type rapid and deep breathing. Parameters were measured before and after three week training period. Savitri pranayam produced a significant increase in respiratory pressures and respiratory endurance. In both the groups, there was an appreciable but statistically insignificant shortening of reaction time. Heart rate, rate-pressure product and double product decreased in savitri pranayam group but increased significantly in bhastrika group. It is concluded that different types of pranayams produce different physiological responses in normal young volunteers.

Clin Exp Pharmacol Physiol. 2005 May-Jun;32(5-6):488-94.

CARDIOVASCULAR AUTONOMIC REGULATION IN SUBJECTS WITH NORMAL BLOOD PRESSURE, HIGH-NORMAL BLOOD PRESSURE AND RECENT-ONSET HYPERTENSION.

Prakash ES, Madanmohan, Sethuraman KR, Narayan SK.

1. In the present study, we tested the hypothesis that heart rate variability (HRV) is reduced in recent-onset hypertension and that pressor responses to standard autonomic reflex tests are not any different in hypertensives compared with normotensives. We also hypothesized that subjects with high-normal blood pressure (BP) would be distinguishable from normotensives on the basis of short-term HRV indices. 2. Three groups of subjects, each consisting of 15 men and 10 women, were examined. The first group consisted of subjects with recent-onset hypertension who were not taking antihypertensive medication (mean (+/-SD) age 50 +/- 12 years; BP >/= 140/90 mmHg), the second group consisted of subjects with high-normal BP (mean age 46 +/- 13 years; BP 130-139/85-89 mmHg) and the third group consisted of subjects with normal BP (mean age 48 +/- 12 years; BP < 120/80 mmHg). The aim was to characterize the autonomic state in each group. 3. Blood pressure, heart rate (HR), indices of short-term HRV during supine rest and quiet standing, HR variation during timed deep breathing (HRVdb) and pressor responses to the cold pressor test and sustained isometric handgrip were compared between the groups. 4. Although the three groups were comparable (P > 0.1) in terms of mean HR and low-frequency (LF) power expressed in normalized units at rest and during quiet standing, the standard deviation of normal-to-normal RR intervals (SDNN) during supine rest, LF and high-frequency spectral powers during supine rest and HRVdb were lowest in hypertensives (P </= 0.05 for each), indicating diminished baroreflex modulation of RR intervals in hypertensives. 5. In contrast, LF power was highest in subjects with high-normal BP (P </= 0.05) during supine rest and this is possibly because of higher BP variability. 6. The results suggest that HRVdb provides a simple measure of cardiac vagal effects in hypertensives, the rate-pressure product provides a simple measure of overall HRV in hypertensives and, in clinical hypertension, the arterial baroreflex mechanism is reset to maintain a higher BP through diminished vagal modulation of HR and possibly heightened sympathetic outflow to the heart and resistance vessels.

Indian J Med Res. 2004 Aug;120(2):115-21.

EFFECT OF SHORT-TERM PRACTICE OF BREATHING EXERCISES ON AUTONOMIC FUNCTIONS IN NORMAL HUMAN VOLUNTEERS.

Pal GK, Velkumary S, Madanmohan.

BACKGROUND & OBJECTIVES: Practice of breathing exercises like pranayama is known to improve autonomic function by changing sympathetic or parasympathetic activity. Therefore, in the present study the effect of breathing exercises on autonomic functions was performed in young volunteers in the age group of 17-19 yr. METHODS: A total of 60 male undergraduate medical students were randomly divided into two groups: slow breathing group (that practiced slow breathing exercise) and the fast breathing group (that practiced fast breathing exercise). The breathing exercises were practiced for a period of three months. Autonomic function tests were performed before and after the practice of breathing exercises. RESULTS: The increased parasympathetic activity and decreased sympathetic activity were observed in slow breathing group, whereas no significant change in autonomic functions was observed in the fast breathing group. INTERPRETATION & CONCLUSION: The findings of the present study show that regular practice of slow breathing exercise for three months improves autonomic functions, while practice of fast breathing exercise for the same duration does not affect the autonomic functions.

Indian J Physiol Pharmacol. 2002 Jul;46(3):307-12.

MODULATION OF COLD PRESSOR-INDUCED STRESS BY SHAVASAN IN NORMAL ADULT VOLUNTEERS.

Madanmohan, Udupa K, Bhavanani AB, Krishnamurthy N, Pal GK.

Shavasan is known to enhance one's ability to combat stressful situations. The present study was planned to determine if shavasan could modulate the physiological response to stress induced by cold pressor test (CPT) and the possible mechanisms involved. Ten normal adults were taught shavasan and practiced the same for a total duration of seven days. RR interval variation (RRIV), deep breathing difference (DBD), and heart rate, blood pressure & rate-pressure-product (RPP) response to CPT were measured before and immediately after shavasan. Shavasan produced a significant increase in DBD and an appreciable but statistically insignificant increase in RRIV suggesting an enhanced parasympathetic activity. Significant blunting of cold pressor-induced increase in heart rate, blood pressure and RPP by shavasan was seen during and even five minutes after CPT suggesting that shavasan reduces the load on the heart by blunting the sympathetic response. It is concluded that shavasan can enhance one's ability to withstand stress induced by CPT and this ability can be achieved even with seven days of shavasan training.

Indian J Physiol Pharmacol. 2008 Apr-Jun;52(2):123-31.

EFFECT OF YOGA BASED LIFESTYLE INTERVENTION ON SUBJECTIVE WELL-BEING.

Sharma R, Gupta N, Bijlani RL.

Yoga is assuming importance in improving mental health and quality of life in the treatment of a number of psychiatric and psychosomatic disorders. The present study was a prospective controlled study to explore the short-term impact of a comprehensive but brief lifestyle intervention, based on yoga, on subjective well being levels in normal and diseased subjects. Normal healthy individuals and subjects having hypertension, coronary artery disease, diabetes mellitus or a variety of other illnesses were included in the study. The outcome measures were

'Subjective well being inventory' (SUBI) scores, taken on the first and last day of the course. The inventory consists of questions related to one's feelings and attitude about various areas of life, such as happiness, achievement and interpersonal relationship. There was significant improvement in the subjective well being scores of the 77 subjects within a period of 10 days as compared to controls. These observations suggest that a short lifestyle modification and stress management educational program leads to remarkable improvement in the subjective well being scores of the subjects and can therefore make an appreciable contribution to primary prevention as well as management of lifestyle diseases.

Indian J Physiol Pharmacol. 2004 Oct;48(4):461-5.

MODULATION OF CARDIOVASCULAR RESPONSE TO EXERCISE BY YOGA TRAINING.

Madanmohan, Udupa K, Bhavanani AB, Shatapathy CC, Sahai A.

This study reports the effects of yoga training on cardiovascular response to exercise and the time course of recovery after the exercise. Cardiovascular response to exercise was determined by Harvard step test using a platform of 45 cm height. The subjects were asked to stepup and down the platform at a rate of 30/min for a total duration of 5min or until fatigue, whichever was earlier. Heart rate (HR) and bloodpressure response to exercise were measured in supine position beforeexercise and at 1, 2, 3, 4, 5, 7 and 10 minutes after the exercise. Ratepressureproduct [RPP = (HR x SP)/100] and double product (Do P =HR x MP), which are indices of work done by the heart were alsocalculated. Exercise produced a significant increase in HR, systolicpressure, RPP & DoP and a significant decrease in diastolic pressure. After two months of yoga training, exercise-induced changes in these parameters were significantly reduced. It is concluded that after yoga training a given level of exercise leads to a milder cardiovascular response, suggesting better exercise tolerance.

Int J Gynaecol Obstet. 2009 Mar;104(3):218-22. Epub 2008 Dec 25.

EFFECT OF INTEGRATED YOGA ON STRESS AND HEART RATE VARIABILITY IN PREGNANT WOMEN.

Satyapriya M, Nagendra HR, Nagarathna R, Padmalatha V.

OBJECTIVE: To study the effect of integrated yoga practice and guided yogic relaxation on both perceived stress and measured autonomic response in healthy pregnant women. METHOD: The 122 healthy women recruited between the 18th and 20th week of pregnancy at prenatal clinics in Bangalore, India, were randomized to practicing yoga and deep relaxation or standard prenatal exercises 1-hour daily. The results for the 45 participants per group who completed the study were evaluated by repeated measures analysis of variance. RESULTS: Perceived stress decreased by 31.57% in the yoga group and increased by 6.60% in the control group (P=0.001). During a guided relaxation period in the yoga group, compared with values obtained before a practice session, the high-frequency band of the heart rate variability spectrum (parasympathetic) increased by 64% in the 20th week and by 150% in the 36th week, and both the low-frequency band (sympathetic), and the low-frequency to high-frequency ratio were concomitantly reduced (P<0.001 between the 2 groups). Moreover, the low-frequency band remained decreased after deep relaxation in the 36th week in the yoga group. CONCLUSION: Yoga reduces perceived stress and improves adaptive autonomic response to stress in healthy pregnant women.

Biofeedback Self Regul 1994 Dec;19(4):353-401

STRESS MANAGEMENT TECHNIQUES: ARE THEY ALL EQUIVALENT, OR DO THEY HAVE SPECIFIC EFFECTS?

Lehrer PM, Carr R, Sargunaraj D, Woolfolk RL.

Department of Psychiatry, Robert Wood Johnson Medical School, Piscataway, New Jersey.

This article evaluates the hypothesis that various stress management techniques have specific effects. Studies comparing various techniques are reviewed, as well as previous literature reviews evaluating the effects of individual techniques. There is evidence that cognitively oriented methods have specific cognitive effects, that specific autonomic effects result from autonomically oriented methods, and that specific muscular effects are produced by muscularly oriented methods. Muscle relaxation and/or EMG biofeedback have greater muscular effects and smaller autonomic effects than finger temperature biofeedback and/or autogenic training. EMG biofeedback produces greater effects on particular muscular groups than progressive relaxation, and thermal biofeedback has greater finger temperature effects than autogenic training. Disorders with a predominant muscular component (e.g., tension headaches) are treated more effectively by muscularly oriented methods, while disorders in which autonomic dysfunction predominates (e.g., hypertension, migraine headaches) are more effectively treated by techniques with a strong

autonomic component. Anxiety and phobias tend to be most effectively treated by methods with both strong cognitive and behavioral components.
Rehabilitation (Stuttg) 1992 Nov;31(4):246-53

Indian J Physiol Pharmacol 2002 Jul;46(3):307-12
MODULATION OF COLD PRESSOR-INDUCED STRESS BY SHAVASAN IN NORMAL ADULT VOLUNTEERS.
Madanmohan, Udupa K, Bhavanani AB, Krishnamurthy N, Pal GK.
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J Assoc Physicians India 2002 May;50(5):633-40
THERAPEUTIC POTENTIAL OF YOGA PRACTICES IN MODIFYING CARDIOVASCULAR RISK PROFILE IN MIDDLE AGED MEN AND WOMEN.
Damodaran A, Malathi A, Patil N, Shah N, Suryavansihi, Marathe S.AIMS OF STUDY: To study 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: 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 quality of life. There was decrease in VMA catecholamine, and decrease MDA level suggestive decrease sympathetic activity and oxidant stress. CONCLUSION: Yoga can play an important role in risk modification for cardiovascular diseases in mild to moderate hypertension.

Cardiol Clin 2002 May;20(2):249-63
NONDRUG INTERVENTIONS IN HYPERTENSION PREVENTION AND CONTROL.
Labarthe D, Ayala C.
This review was undertaken to address the relation of various factors to HBP and their potential for preventing and controlling this widespread problem. With respect to salt intake and BP, the 1999 Workshop on Sodium and Blood Pressure of the (US) National Heart, Lung, and Blood Institute [5] will serve the reader well as a point of departure. The body of the present review provides more detailed discussion especially of recent epidemiologic research, including the DASH-Sodium trial, published more recently than the proceedings of that workshop. The DASH-Sodium trial demonstrates significant increases in SBP and DBP, with sodium intake greater than 65 mmol/d (= 3.7 g NaCl--see equivalencies in Appendix A) and with the usual American diet (versus the DASH diet). These results provide substantial evidence against current dietary practices in many populations where daily

intakes of salt are much higher than recommended. We also have addressed alcohol consumption, micronutrients/macronutrients, physical activity and inactivity, obesity, cigarette smoking, and alternative approaches to treatment such as stress reduction/biofeedback, yoga/meditation, and acupuncture. Evidence for the efficacy of certain nonpharmacologic approaches to preventing and controlling HBP is strong. This evidence offers a basis for public health policies and clinical approaches that can greatly affect the incidence and consequences of HBP in the population at large. What is needed now is implementation of the policies and practices addressed here. Unless such action is taken on a large scale, we will have made poor use of the knowledge accrued over decades of research. The clinician is referred to the National Heart, Lung and Blood Institute Web site at www.nhlbi.gov/health/prof/heart/index.htm for resource and guideline information for hypertension. Patients and the general public are referred to the sister web page at www.nhlbi.gov\health\public\heart\index.htm for educational fact sheets and general information on hypertension.

J Indian Med Assoc 1999 Jun;97(6):220-5

NON-PHARMACOLOGICAL MANAGEMENT OF ESSENTIAL HYPERTENSION.

Anand MP.

Lifestyle modifications are universally accepted, not only as the first step in the management of hypertension but also a way to prevent hypertension. The INTERSALT study of 52 communities worldwide showed that weight, among all measured characteristics except age, had the strongest, significant, most consistent and independent correlation with blood pressure. INTERSALT epidemiological data had demonstrated a positive association between sodium intake and level of blood pressure. A rigorous analysis of 23 randomly controlled trials showed that 100 mmol/day reduction in sodium intake was associated with a decline of 5-7 mm Hg (systolic)/2.7 mm Hg (diastolic) in hypertensive subjects. Excessive alcohol consumption is another important risk factor for hypertension and has been reported to account for 5-30% of all hypertension. Moderately intense exercise at 40 to 60% of maximum oxygen consumption e.g., 30 to 45 minutes of brisk walking on 4-5 days a week, can lower blood pressure. The incidence of stroke and coronary artery disease in hypertensive patients who smoke is 2-3 times greater than in non-smoking patients with comparable blood pressure and stopping smoking rapidly reduces this risk. There have been several studies showing the stress reduction with various behavioural procedures, such as yoga, relaxation biofeedback, transcedental mediation and psychotherapy benefit hypertensive patients by lowering their blood pressure.

J Assoc Physicians India 2000 Jul;48:687-94

RETARDATION OF CORONARY ATHEROSCLEROSIS WITH YOGA LIFESTYLE INTERVENTION.

Manchanda SC, Narang R, Reddy KS, Sachdeva U, Prabhakaran D, Dharmanand S, Rajani M, Bijlani R.

BACKGROUND: Yoga has potential for benefit for patients with coronary artery disease though objective, angiographic studies are lacking. MATERIAL AND METHODS: We evaluated 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 program 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 program was excellent and no side effects were observed. CONCLUSION: 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.

Indian J Physiol Pharmacol. 2004 Oct;48(4):461-5.

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Madanmohan, Udupa K, Bhavanani AB, Shatapathy CC, Sahai A.

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Indian J Physiol Pharmacol 1998 Oct;42(4):473-8

RECOVERY FROM STRESS IN TWO DIFFERENT POSTURES AND IN SHAVASANA--A YOGIC RELAXATION POSTURE.

Bera TK, Gore MM, Oak JP.

The recovery from induced physiological stress in Shavasana (a yogic relaxation posture) and two other postures (resting in chair and resting supine posture) was compared. Twenty one males and 6 females (age 21-30 yrs) were allowed to take rest in one of the above postures immediately after completing the scheduled treadmill running. The recovery was assessed in terms of Heart Rate (HR) and Blood pressure (BP). HR and BP were measured before and every two minutes after the treadmill running till they returned to the initial level. The results revealed that the effects of stress was reversed in significantly (P < 0.01) shorter time in Shavasana, compared to the resting posture in chair and a supine posture

Cardiol Clin 2002 May;20(2):249-63

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This review was undertaken to address the relation of various factors to HBP and their potential for preventing and controlling this widespread problem. With respect to salt intake and BP, the 1999 Workshop on Sodium and Blood Pressure of the (US) National Heart, Lung, and Blood Institute [5] will serve the reader well as a point of departure. The body of the present review provides more detailed discussion especially of recent epidemiologic research, including the DASH-Sodium trial, published more recently than the proceedings of that workshop. The DASH-Sodium trial demonstrates significant increases in SBP and DBP, with sodium intake greater than 65 mmol/d (= 3.7 g NaCl--see equivalencies in Appendix A) and with the usual American diet (versus the DASH diet). These results provide substantial evidence against current dietary practices in many populations where daily intakes of salt are much higher than recommended. We also have addressed alcohol consumption, micronutrients/macronutrients, physical activity and inactivity, obesity, cigarette smoking, and alternative approaches to treatment such as stress reduction/biofeedback, yoga/meditation, and acupuncture. Evidence for the efficacy of

certain nonpharmacologic approaches to preventing and controlling HBP is strong. This evidence offers a basis for public health policies and clinical approaches that can greatly affect the incidence and consequences of HBP in the population at large. What is needed now is implementation of the policies and practices addressed here. Unless such action is taken on a large scale, we will have made poor use of the knowledge accrued over decades of research. The clinician is referred to the National Heart, Lung and Blood Institute Web site at www.nhlbi.gov/health/prof/heart/index.htm for resource and guideline information for hypertension. Patients and the general public are referred to the sister web page at www.nhlbi.gov\health\public\heart\index.htm for educational fact sheets and general information on hypertension.

Clin Sci Mol Med Suppl 1975 Jun;2:171s-174s

YOGA AND BIOFEEDBACK IN THE MANAGEMENT OF 'STRESS' IN HYPERTENSIVE PATIENTS.

Patel C.

Psychophysical relaxation exercises based on yogic principles and reinforced by biofeedback instruments were used for behaviour modification in sixteen hypertensive subjects. Preliminary studies indicated that their pressor response to emotional and physical stimuli became less exaggerated and less protracted compared with controls.

Aviat Space Environ Med 1989 Jul;60(7):684-7

TREATMENT OF ESSENTIAL HYPERTENSION WITH YOGA RELAXATION THERAPY IN A USAF AVIATOR: A CASE REPORT

BROWNSTEIN AH, DEMBERT ML.

A 46-year-old Caucasian male USAF aviator with a 6-year history of mild essential hypertension (medical waiver for flight duty) under unsuccessful treatment with hydrochlorothiazide, dietary modification, and exercise, was subsequently trained in yoga relaxation. After 6 weeks, medication had been discontinued, and his diastolic blood pressure remained within normal levels. The patient was subsequently returned to full flight status without recurrence of diastolic hypertension at followup 6 months later. Relaxation training, of which yoga is one type, has been reported in the medical literature to have wide clinical application. It should be considered as a nonpharmacological therapy adjunct or alternative for medical disorders among personnel in occupations (e.g., aviation) where the side effects from medications are of great concern and could be disqualifying from those duties.

Lancet 1975 Jul 19;2(7925):93-5

RANDOMISED CONTROLLED TRIAL OF YOGA AND BIO-FEEDBACK IN MANAGEMENT OF HYPERTENSION.

PATEL C, NORTH WR.

34 hypertensive patients were assigned at random either to six weeks' treatment by yoga relaxation methods with bio-feedback or to placebo therapy (general relaxation). Both groups showed a reduction in blood-pressure (from 168/100 to 141/84 mm. Hg in the treated group and from 169/101 to 160/96 mm Hg in the control group). The difference was highly significant. The control group was then trained in yoga relaxation, and their blood-pressure fell to that of the other group (now used as controls).

MMW Fortschr Med 2002 May 9;144(19):38-41

ESSENTIAL HYPERTENSION AND STRESS. WHEN DO YOGA, PSYCHOTHERAPY AND AUTOGENIC TRAINING HELP?

Herrmann JM.

Psychosocial factors play an important role in the development and course of essential hypertension, although "stress" can account for only 10% of blood pressure variance. A variety of psychotherapeutic interventions, such as relaxation techniques (autogenic

training or progressive muscular relaxation), behavioral therapy or biofeedback techniques, can lower elevated blood pressure by an average of 10 mmHg (systolic) and 5 mmHg (diastolic). As a "secondary effect", such measures may also prompt the hypertensive to adopt a more health-conscious lifestyle.

J Indian Med Assoc 2001 Sep;99(9):504-8
STATUS OF LIFESTYLE MODIFICATIONS IN HYPERTENSION.
Chhabra MK, Lal A, Sharma KK.
Hypertension is essentially the elevation of arterial blood pressure beyond an arbitrary cut off point, though the dividing line between normal and elevated BP is lacking. Hypertension can be classified into primary, essential or idiopathic hypertension on one hand, and secondary one due to some disease itself. In treating hypertension, antihypertensives have their role, but attention may be directed towards some lifestyle modifications. As regarding dietary interventions, calorie restriction may influence the minimisation of BP. Body weight reduction, less alcohol consumption, salt restriction, potassium and calcium supplementation can enhance the process of lowering BP. The role of magnesium in hypertension is debatable. Serum cholesterol level is commonly elevated in hypertensive patients and its reduction reduces the risk of non-fatal coronary events. Diet rich in plant fibres either alone or with a low fat, low sodium could lower the BP by about 5 mm Hg in hypertensives. The omega-3-polyunsaturated fatty acids found in highest concentrations in cold water fishes have a modest antihypertensive effect. Caffeine contained in two cups of coffee may raise the BP by 5 mm Hg in infrequent users but in habitual users, caffeine has no role. Deficiency of vitamin C might lead to hypertension. As regarding behavioural changes, stopping smoking, regular physical exercise, relaxation therapies like yoga, etc, have definite beneficial effect on hypertensives. The antihypertensive effect of lifestyle modifications may obviate drug therapy. For this one or more of the lifestyle modifications should be tried initially in all hypertensive patients.

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Lifestyle modifications are universally accepted, not only as the first step in the management of hypertension but also a way to prevent hypertension. The INTERSALT study of 52 communities worldwide showed that weight, among all measured characteristics except age, had the strongest, significant, most consistent and independent correlation with blood pressure. INTERSALT epidemiological data had demonstrated a positive association between sodium intake and level of blood pressure. A rigorous analysis of 23 randomly controlled trials showed that 100 mmol/day reduction in sodium intake was associated with a decline of 5-7 mm Hg (systolic)/2.7 mm Hg (diastolic) in hypertensive subjects. Excessive alcohol consumption is another important risk factor for hypertension and has been reported to account for 5-30% of all hypertension. Moderately intense exercise at 40 to 60% of maximum oxygen consumption e.g., 30 to 45 minutes of brisk walking on 4-5 days a week, can lower blood pressure. The incidence of stroke and coronary artery disease in hypertensive patients who smoke is 2-3 times greater than in non-smoking patients with comparable blood pressure and stopping smoking rapidly reduces this risk. There have been several studies showing the stress reduction with various behavioural procedures, such as yoga, relaxation biofeedback, transcedental mediation and psychotherapy benefit hypertensive patients by lowering their blood pressure.

J Hypertens Suppl 1990 Sep;8(4):S21-6
NON-PHARMACOLOGICAL TREATMENT OF HYPERTENSION.
Silverberg DS.
Weight reduction, alcohol restriction, mild salt restriction, eating a vegetarian diet and increasing aerobic exercise will generally lower the blood pressure in patients with essential hypertension. Eating a diet rich in potassium and reducing caffeine intake may also be

helpful in reducing the pressure, but increasing the fiber or calcium intake will generally be ineffective. Reducing fat intake from the usual 40% of total calories to 25-30% may reduce hypertension directly or by weight reduction. Smoking, when combined with excessive caffeine or alcohol intake may have an additive effect on blood pressure. Monotherapy with such behavioral techniques as self-monitoring of blood pressure, biofeedback, meditation, yoga, progressive muscular relaxation or cognitive therapy may reduce the blood pressure to a variable degree, and combinations of these treatments may be even more successful.

Lancet 1976 Jan 31;1(7953):223-6

TRANSCENDENTAL MEDITATION IN HYPERTENSION. INDIVIDUAL RESPONSE PATTERNS.

Blackwell B, Bloomfield S, Gartside P, Robinson A, Hanenson I, Magenheim H, Nidich S, Zigler R.

Seven selected hypertensive patients were stabilized on drugs at a research clinic. Subjects learned transcendental meditation (T.M.), were seen weekly, and took their own blood pressure several times daily. After 12 weeks of T.M. six subjects showed psychological changes and reduced anxiety scores. Six subjects also showed significant reductions in home and four in clinic blood-pressures. Six months later four subjects continued to derive psychological benefit and two showed significant blood-pressure reductions attributable to T.M. at home and clinic.

BMJ 1990 May 26;300(6736):1368-72

RELAXATION THERAPY AND CONTINUOUS AMBULATORY BLOOD PRESSURE IN MILD HYPERTENSION: A CONTROLLED STUDY.

Van Montfrans GA, Karemaker JM, Wieling W, Dunning AJ.

OBJECTIVE--To determine 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 randomisation to receive either relaxation therapy or non-specific counselling 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 counselling. 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 -0.4 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 nighttime 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.

J Assoc Physicians India 2000 Jul;48(7):687-94

RETARDATION OF CORONARY ATHEROSCLEROSIS WITH YOGA LIFESTYLE INTERVENTION.

Manchanda SC, Narang R, Reddy KS, Sachdeva U, Prabhakaran D, Dharmanand S, Rajani M, Bijlani R.

BACKGROUND: Yoga has potential for benefit for patients with coronary artery disease though objective, angiographic studies are lacking. MATERIAL AND METHODS: We evaluated 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 program 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 program was excellent and no side effects were observed. CONCLUSION: 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.

Appl Psychophysiol Biofeedback 2000 Dec;25(4):221-7

OXYGEN CONSUMPTION AND RESPIRATION FOLLOWING TWO YOGA RELAXATION TECHNIQUES.

Telles S, Reddy SK, Nagendra HR.

The present study was conducted to evaluate a statement in ancient yoga texts 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 "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.

Cardiol Clin 2002 May;20(2):249-63

NONDRUG INTERVENTIONS IN HYPERTENSION PREVENTION AND CONTROL.

Labarthe D, Ayala C.

This review was undertaken to address the relation of various factors to HBP and their potential for preventing and controlling this widespread problem. With respect to salt intake and BP, the 1999 Workshop on Sodium and Blood Pressure of the (US) National Heart,

Lung, and Blood Institute [5] will serve the reader well as a point of departure. The body of the present review provides more detailed discussion especially of recent epidemiologic research, including the DASH-Sodium trial, published more recently than the proceedings of that workshop. The DASH-Sodium trial demonstrates significant increases in SBP and DBP, with sodium intake greater than 65 mmol/d (= 3.7 g NaCl--see equivalencies in Appendix A) and with the usual American diet (versus the DASH diet). These results provide substantial evidence against current dietary practices in many populations where daily intakes of salt are much higher than recommended. We also have addressed alcohol consumption, micronutrients/macronutrients, physical activity and inactivity, obesity, cigarette smoking, and alternative approaches to treatment such as stress reduction/biofeedback, yoga/meditation, and acupuncture. Evidence for the efficacy of certain nonpharmacologic approaches to preventing and controlling HBP is strong. This evidence offers a basis for public health policies and clinical approaches that can greatly affect the incidence and consequences of HBP in the population at large. What is needed now is implementation of the policies and practices addressed here. Unless such action is taken on a large scale, we will have made poor use of the knowledge accrued over decades of research. The clinician is referred to the National Heart, Lung and Blood Institute Web site at www.nhlbi.gov/health/prof/heart/index.htm for resource and guideline information for hypertension. Patients and the general public are referred to the sister web page at www.nhlbi.gov\health\public\heart\index.htm for educational fact sheets and general information on hypertension.

J Assoc Physicians India 2002 May;50(5):633-40
Comment in: J Assoc Physicians India. 2002 May;50(5):631-2.

THERAPEUTIC POTENTIAL OF YOGA PRACTICES IN MODIFYING CARDIOVASCULAR RISK PROFILE IN MIDDLE AGED MEN AND WOMEN.

Damodaran A, Malathi A, Patil N, Shah N, Suryavansihi, Marathe S.

AIMS OF STUDY: To study 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: 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 quality of life. There was decrease in VMA catecholamine, and decrease MDA level suggestive decrease sympathetic activity and oxidant stress. CONCLUSION: Yoga can play an important role in risk modification for cardiovascular diseases in mild to moderate hypertension.

J Indian Med Assoc 2001 Sep;99(9):504-8,

STATUS OF LIFESTYLE MODIFICATIONS IN HYPERTENSION.

Chhabra MK, Lal A, Sharma KK.

Hypertension is essentially the elevation of arterial blood pressure beyond an arbitrary cut off point, though the dividing line between normal and elevated BP is lacking. Hypertension can be classified into primary, essential or idiopathic hypertension on one hand, and secondary one due to some disease itself. In treating hypertension, antihypertensives have their role, but attention may be directed towards some lifestyle modifications. As regarding dietary interventions, calorie restriction may influence the minimisation of BP. Body weight reduction, less alcohol consumption; salt restriction, potassium and calcium supplementation can enhance the process of lowering BP. The role of magnesium in hypertension is debatable. Serum cholesterol level is commonly elevated in hypertensive patients and its reduction reduces the risk of non-fatal coronary events. Diet rich in plant

fibers either alone or with a low fat, low sodium could lower the BP by about 5 mm Hg in hypertensives. The omega-3-polyunsaturated fatty acids found in highest concentrations in cold water fishes have a modest antihypertensive effect. Caffeine contained in two cups of coffee may raise the BP by 5 mm Hg in infrequent users but in habitual users, caffeine has no role. Deficiency of vitamin C might lead to hypertension. As regarding behavioral changes, stopping smoking, regular physical exercise, relaxation therapies like yoga, etc, have definite beneficial effect on hypertensives. The antihypertensive effect of lifestyle modifications may obviate drug therapy. For this one or more of the lifestyle modifications should be tried initially in all hypertensive patients.

MMW Fortschr Med 2002 May 9;144(19):38-41
[ESSENTIAL HYPERTENSION AND STRESS. WHEN DO YOGA, PSYCHOTHERAPY AND AUTOGENIC TRAINING HELP?] [Article in German]
Herrmann JM.
Psychosocial factors play an important role in the development and course of essential hypertension, although "stress" can account for only 10% of blood pressure variance. A variety of psychotherapeutic interventions, such as relaxation techniques (autogenic training or progressive muscular relaxation), behavioral therapy or biofeedback techniques, can lower elevated blood pressure by an average of 10 mmHg (systolic) and 5 mmHg (diastolic). As a "secondary effect", such measures may also prompt the hypertensive to adopt a more health-conscious lifestyle.

J Indian Med Assoc 2000 Apr;98(4):176-9
THE PROBLEMS OF HYPERTENSION IN THE ELDERLY.
Arya SN.
The cut off age for elderly person in India is 60-65 years, in the USA is 75-80 years and 6th Joint Committee on Detection, Evaluation and Treatment of High Blood Pressure (JNC-VI) has identified it as above 60 years. Elderly people may have (i) systolic-diastolic hypertension, (ii) isolated systolic hypertension or (iii) pseudohypertension. JNC-VI has classified hypertension in stage 1, stage 2 and stage 3 according to its severity. Hypertension is confirmed when BP measured on three separate occasions over 1-2 weeks and when consistently it is raised above 140/90 mm Hg. The management includes lifestyle modification and drug treatment. Lifestyle modification includes rationality of diet, regular exercise; stop smoking, stoppage of alcohol or moderation and yoga. Drugs commonly used are diuretics and beta-blockers. Other antihypertensive drugs are calcium channel blockers, ACE-inhibitors, alpha-blockers and vasodilators.

J Hypertens Suppl 1990 Sep;8(4):S21-6
NON-PHARMACOLOGICAL TREATMENT OF HYPERTENSION.
Silverberg DS.
Weight reduction, alcohol restriction, mild salt restriction, eating a vegetarian diet and increasing aerobic exercise will generally lower the blood pressure in patients with essential hypertension. Eating a diet rich in potassium and reducing caffeine intake may also be helpful in reducing the pressure, but increasing the fiber or calcium intake will generally be ineffective. Reducing fat intake from the usual 40% of total calories to 25-30% may reduce hypertension directly or by weight reduction. Smoking, when combined with excessive caffeine or alcohol intake may have an additive effect on blood pressure. Monotherapy with such behavioral techniques as self-monitoring of blood pressure, biofeedback, meditation, yoga, progressive muscular relaxation or cognitive therapy may reduce the blood pressure to a variable degree, and combinations of these treatments may be even more successful.

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TRANSCENDENTAL MEDITATION IN HYPERTENSION. INDIVIDUAL RESPONSE PATTERNS.

Blackwell B, Bloomfield S, Gartside P, Robinson A, Hanenson I, Magenheim H, Nidich S, Zigler R.
Seven selected hypertensive patients were stabilized on drugs at a research clinic. Subjects learned transcendental meditation (T.M.), were seen weekly, and took their own blood pressure several times daily. After 12 weeks of T.M. six subjects showed psychological changes and reduced anxiety scores. Six subjects also showed significant reductions in home and four in clinic blood-pressures. Six months later four subjects continued to derive psychological benefit and two showed significant blood-pressure reductions attributable to T.M. at home and clinic.

Acta Cardiol 1984;39(3):203-8
ROLE OF YOGA IN MANAGEMENT OF ESSENTIAL HYPERTENSION.
Sundar S, Agrawal SK, Singh VP, Bhattacharya SK, Udupa KN, Vaish SK.
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 practising yoga. Thus, with 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.

Br Med J (Clin Res Ed) 1982 May 22;284(6328):1523-6
HYPERTENSION: COMPARISON OF DRUG AND NON-DRUG TREATMENTS.
Andrews G, MacMahon SW, Austin A, Byrne DG.
Thirty-seven reports of the treatment of hypertension by non-pharmacological means were compared with the results of treatment by standard drug regimens. Treatment by drugs produced the greatest lowering of blood pressure. Treatment by weight reduction, yoga, and muscle relaxation each produced smaller, but appreciable, changes in blood pressure biofeedback, and salt restriction were inferior to those of the other regimens and were not significantly different to the effects of placebo treatment. Large comparative trials of pharmacological and non-pharmacological treatments are needed before definite conclusions can be made.

Psychosom Med 1978 Jun;40(4):294-320
NON PHARMACOLOGIC CONTROL OF ESSENTIAL HYPERTENSION IN MAN: A CRITICAL REVIEW OF THE EXPERIMENTAL LITERATURE.
Frumkin K, Nathan RJ, Prout MF, Cohen MC.
Many non pharmacologic (behavioral) techniques are being proposed for the therapy of essential hypertension. The research in this area is reviewed and divided roughly into two categories: the biofeedback and relaxation methodologies. While feedback can be used to lower pressures during laboratory training sessions, studies designed to alter basal blood pressure levels with biofeedback have not yet been reported. The absence of evidence for such changes through biofeedback limits the usefulness of this technique in hypertension control. The various relaxation methods, such as yoga, transcendental meditation, progressive muscle relaxation, and others have shown more promise. With varying degrees of experimental vigor, many of these techniques have been associated with long-lasting changes in blood pressure. The strengths and weaknesses of the various authors' research designs, data and conclusions are discussed, and suggestions for further experimentation are offered.

Progress in Cardiovascular Nursing, Spring 2002, 17(2):73-80.
Healing the heart: Integrating complementary therapies and healing practices into the care of cardiovascular patients.
Kreitzer, M. J., and M. Snyder.
Complementary therapies and healing practices have been found to reduce stress, anxiety, and lifestyle patterns that are known to contribute to cardiovascular disease. Promising therapies include imagery and hypnosis, meditation, yoga, tai chi, prayer, music, exercise, diet, and use of dietary supplements. Many of these approaches have been within nursing's domain for centuries and can easily be integrated into the care of cardiovascular patients. Although each complementary modality holds significant merit on its own, it is critically important that the basic philosophy underlying all these therapies—caring, holism, and harmony—be understood and honored.

Alternative Therapies in Health and Medicine, Jul-Aug 2002, 8(4):64-66, 68-70, 72-73.
Changes in spirituality and well-being in a retreat program for cardiac patients.
Kennedy, J. E., R. A. Abbott, and B. S. Rosenberg.
The purpose of this study was to evaluate whether participation in a retreat program for cardiac patients and their partners would result in changes in spirituality and whether these changes were related to changes in well-being, meaning in life, anger, and confidence in handling problems. 72 participants from cardiac rehabilitation programs filled out questionnaires before and after participating in the 2.5-day retreat, which included discussion and opportunities to experience healthy lifestyle options, exercise, nutrition, stress management techniques, communication skills that enhance social support, and spiritual principles of healing. Experiential practices included Yoga, meditation, visualization, and prayer. 78% of participants reported increased spirituality after the retreat, and these changes were positively associated with increased well-being, meaning in life, confidence in handling problems, and decreased tendency to become angry. Many patients and their families want to integrate the spiritual and health dimensions of their lives, and further work is needed to develop healthcare settings that can support this.

Indian J Physiol Pharmacol. 1998 Apr;42(2):205-13.
A NEW PHYSIOLOGICAL APPROACH TO CONTROL ESSENTIAL HYPERTENSION.
Selvamurthy W, Sridharan K, Ray US, Tiwary RS, Hegde KS, Radhakrishan U, Sinha KC.
This study was conducted on 20 male patients of Essential Hypertension (EH) in order to explore the possible role of baroreflex mechanism in the etiology of EH and also to find out whether by restoration of baroreflex sensitivity to normal level either by postural tilt stimulus on a tilt table or by the equivalent yogic postural exercise (Yogic asanas), the EH could be cured or controlled. Patients on therapeutic regime were gradually withdrawn from drug therapy, and later divided into two groups of 10 each. Group-I (age 34 +/- 1.7 years) was subjected to a 3 week course of 70 degrees head-up tilt for 30 min daily, while in group-II (age 50 +/- 3.3 years), specific yogic exercises equivalent to head-up or head-down tilt were administered for the same duration. The progressive autonomic readjustments were assessed by a battery of tests including cardiovascular responses to head up tilt, cold pressor response at 4 degrees C water (CPR), alpha index of EEG (AI), level of blood catecholamines (CA) and plasma renin activity (PRA). At the end of 3 weeks, there was a significant reduction ($P < 0.001$) in blood pressure in both the groups. Progressive changes in BP and HR response to tilt during 3 weeks course of tilt and yogic exercise clearly indicated gradual improvement in baroreflex sensitivity. Likewise, changes in other indices like CPR, AI, CA and PRA indicated progressive attenuation of sypatho-adrenal and renin-angiotensin activity. All these changes together with the reduction in BP strongly suggest a close link between the etiology of EH and baroreflexes on the one hand and controlling influence of the latter on sympatho-adrenal and renin-angiotensin systems on the other. It also throws light on the physiological mechanism underlying the effects of selected yogic exercises in the treatment of EH.

Psychosom Med. 2010 Jan 11. [Epub ahead of print]

STRESS, INFLAMMATION, AND YOGA PRACTICE.

Kiecolt-Glaser JK, Christian L, Preston H, Houts CR, Malarkey WB, Emery CF, Glaser R.

Objective: To address the mechanisms underlying hatha yoga's potentialstress-reduction benefits, we compared inflammatory and endocrine responses ofnovice and expert yoga practitioners before, during, and after a restorativehatha yoga session, as well as in two control conditions. Stressors before eachof the three conditions provided data on the extent to which yoga speeded an individual's physiological recovery. Methods: A total of 50 healthy women (meanage, 41.32 years; range, 30-65 years), 25 novices and 25 experts, were exposed toeach of the conditions (yoga, movement control, and passive-video control) during three separate visits. Results: The yoga session boosted participants' positive affect compared with the control conditions, but no overall differences ininflammatory or endocrine responses were unique to the yoga session. Importantly, even though novices and experts did not differ on key dimensions, including age, abdominal adiposity, and cardiorespiratory fitness, novices' serum interleukin(IL)-6 levels were 41% higher than those of experts across sessions, and the oddsof a novice having detectable C-reactive protein (CRP) were 4.75 times as high asthat of an expert. Differences in stress responses between experts and novicesprovided one plausible mechanism for their divergent serum IL-6 data; expertsproduced less lipopolysaccharide-stimulated IL-6 in response to the stressor thannovices, and IL-6 promotes CRP production. Conclusion: The ability to minimizeinflammatory responses to stressful encounters influences the burden thatstressors place on an individual. If yoga dampens or limits stress-relatedchanges, then regular practice could have substantial health benefits.

Complement Ther Clin Pract. 2009 May;15(2):102-4. Epub 2009 Mar 20.

EFFECTS OF YOGA ON DEPRESSION AND ANXIETY OF WOMEN.

Javnbakht M, Hejazi Kenari R, Ghasemi M.

Yoga has often been perceived as a method of stress management tool that can assist in alleviating depression and anxiety disorders. This study sought to evaluate the influence of yoga in relieving symptoms of depression and anxiety in women who were referred to a yoga clinic. METHODS: The study involved a convenience sample of women who were referred to a yoga clinic from July 2006 to July 2007. All new cases were evaluated on admission using a personal information questionnaire well as Beck and Spielberger tests. Participants were randomly assigned into an experimental and a control group. The experimental group (n=34) participated in twice weekly yoga classes of 90 min duration for two months. The control group (n=31) was assigned to a waiting list and did not receive yoga. Both groups were evaluated again after the two-month study period. RESULTS: The average prevalence of depression in the experimental group pre and post Yoga intervention was 12.82+/-7.9 and 10.79+/-6.04 respectively, a statistically insignificant decrease (p=0.13). However, when the experimental group was compared to the control group, women who participated in yoga classes showed a significant decrease in state anxiety (p=0.03) and trait anxiety (p<0.001). CONCLUSIONS: Participation in a two-month yoga class can lead to significant reduction in perceived levels of anxiety in women who suffer from anxiety disorders. This study suggests that yoga can be considered as a complementary therapy or an alternative method for medical therapy in the treatment of anxiety disorders.

J Altern Complement Med. 2009 Mar; 15(3):293-5.

IMMEDIATE EFFECT OF SLOW PACE BHASTRIKA PRANAYAMA ON BLOOD PRESSURE AND HEART RATE.

Pramanik T, Sharma HO, Mishra S, Mishra A, Prajapati R, Singh S.

OBJECTIVES: The objective of this study was to evaluate the immediate effect of slow pace bhastrika pranayama (respiratory rate 6/min) for 5 minutes on heart rate and blood pressure and the effect of the same breathing exercise for the same duration of time (5

minutes) following oral intake of hyoscine-N-butylbromide (Buscopan), a parasympathetic blocker drug. SUBJECTS AND METHODS: Heart rate and blood pressure of volunteers (n = 39, age = 25-40 years) was recorded following standard procedure. First, subjects had to sit comfortably in an easy and steady posture (sukhasana) on a fairly soft seat placed on the floor keeping head, neck, and trunk erect, eyes closed, and the other muscles reasonably loose. The subject is directed to inhale through both nostrils slowly up to the maximum for about 4 seconds and then exhale slowly up to the maximum through both nostrils for about 6 seconds. The breathing must not be abdominal. These steps complete one cycle of slow pace bhastrika pranayama (respiratory rate 6/min). During the practice the subject is asked not to think much about the inhalation and exhalation time, but rather was requested to imagine the open blue sky. The pranayama was conducted in a cool, well-ventilated room (18-20 degrees C). After 5 minutes of this breathing practice, the blood pressure and heart rate again were recorded in the aforesaid manner using the same instrument. The other group (n = 10) took part in another study where their blood pressure and heart rate were recorded following half an hour of oral intake of hyoscine-N-butylbromide 20 mg. Then they practiced the breathing exercise as stated above, and the abovementioned parameters were recorded again to study the effect of parasympathetic blockade on the same pranayama. RESULTS: It was noted that after slow bhastrika pranayamic breathing (respiratory rate 6/min) for 5 minutes, both the systolic and diastolic blood pressure decreased significantly with a slight fall in heart rate. No significant alteration in both blood pressure and heart rate was observed in volunteers who performed the same breathing exercise for the same duration following oral intake of hyoscine-N-butylbromide. DISCUSSION: Pranayama increases frequency and duration of inhibitory neural impulses by activating pulmonary stretch receptors during above tidal volume inhalation as in Hering Bruer reflex, which bring about withdrawal of sympathetic tone in the skeletal muscle blood vessels, leading to widespread vasodilatation, thus causing decrease in peripheral resistance and thus decreasing the diastolic blood pressure. After hyoscine-N-butylbromide, the parasympathetic blocker, it was observed that blood pressure was not decreased significantly as a result of pranayama, as it was observed when no drug was administered. CONCLUSIONS: Vagal cardiac and pulmonary mechanisms are linked, and improvement in one vagal limb might spill over into the other. Baroreceptor sensitivity can be enhanced significantly by slow breathing (supported by a small reduction in the heart rate observed during slow breathing and by reduction in both systolic and diastolic pressure). Slow pace bhastrika pranayama (respiratory rate 6/min) exercise thus shows a strong tendency to improving the autonomic nervous system through enhanced activation of the parasympathetic system.

J Altern Complement Med. 2009 Jul;15(7):711-7.

EFFECT OF SLOW- AND FAST-BREATHING EXERCISES ON AUTONOMIC FUNCTIONS IN PATIENTS WITH ESSENTIAL HYPERTENSION.

Mourya M, Mahajan AS, Singh NP, Jain AK.

OBJECTIVES: Breathing exercises practiced in various forms of meditations such as yoga may influence autonomic functions. This may be the basis of therapeutic benefit to hypertensive patients. DESIGN: The study design was a randomized, prospective, controlled clinical study using three groups. SUBJECTS: The subjects comprised 60 male and female patients aged 20-60 years with stage 1 essential hypertension. INTERVENTION: Patients were randomly and equally divided into the control and other two intervention groups, who were advised to do 3 months of slow-breathing and fast-breathing exercises, respectively. Baseline and postintervention recording of blood pressure (BP), autonomic function tests such as standing-to-lying ratio (S/L ratio), immediate heart rate response to standing (30:15 ratio), Valsalva ratio, heart rate variation with respiration (E/I ratio), hand-grip test, and cold pressor response were done in all subjects. RESULTS: Slow breathing had a stronger effect than fast breathing. BP decreased longitudinally over a 3-month period with both interventions. S/L ratio, 30:15 ratio, E/I ratio, and BP response in the hand grip and cold pressor test showed significant change only in patients practicing the

slow-breathing exercise. CONCLUSIONS: Both types of breathing exercises benefit patients with hypertension. However, improvement in both the sympathetic and parasympathetic reactivity may be the mechanism that is associated in those practicing the slow-breathing exercise.

Indian J Physiol Pharmacol. 2005 Jul-Sep;49(3):358-62.

EFFECT OF A COMPREHENSIVE YOGA-BASED LIFESTYLE MODIFICATION PROGRAM ON LIPID PEROXIDATION.

Yadav RK, Ray RB, Vempati R, Bijlani RL.

Oxidative stress contributes to the process of aging as well as a variety of chronic degenerative diseases. There are indications that psychological stress increases oxidative stress whereas relaxation decreases it. We have measured the concentration of thiobarbituric acid reactive substances (TBARS) in blood as an indicator of oxidative stress at the beginning and at the end of a comprehensive yoga-based lifestyle modification program (YLMP). The data was collected from 104 subjects (59 male, 45 female), 19-71 years of age (mean +/- SD, 41.2 +/- 14.6 years). The YLMP consisted of a nine-day educational out-patient course on the theory and practice of yoga and included, besides a daily one-hour practice of physical postures (asanas) and breathing exercises (pranayama), lecture and films on yoga, stress management and nutrition, practice of meditation and shavasana (a relaxation technique), and individual counseling. Venous blood samples were collected on the first and last day of the course. The serum concentration of TBARS decreased significantly from 1.72 +/- 0.72 nmoles/ml on day 1 to 1.57 +/- 0.72 nmoles/ml on day 10 ($P<0.05$). The study suggests that a brief low cost lifestyle intervention based on yoga reduces oxidative stress.

Holist Nurs Pract. 2005 Jul-Aug;19(4):173-80.

THE EFFECTS OF YOGA ON HYPERTENSIVE PERSONS IN THAILAND.

McCaffrey R, Ruknui P, Hatthakit U, Kasetsomboon P.

To determine the effectiveness of a yoga program on blood pressure and stress, a group of hypertensive patients in Thailand were studied, with the experimental group showing significantly decreased mean stress scores and blood pressure, heart rate, and body mass index levels compared with the control group. Further studies are suggested to determine the effects of yoga on hypertension in Thailand.

Indian J Physiol Pharmacol. 2000 Apr;44(2):207-10.

EFFECT OF SELECTED YOGIC PRACTICES ON THE MANAGEMENT OF HYPERTENSION.

Murugesan R, Govindarajulu N, Bera TK.

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-1 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 ANCOVA revealed that both the treatment stimuli (i.e., yoga and drug) were effective in controlling the variables of hypertension.

Evid Based Complement Alternat Med. 2009 Sep 4. [Epub ahead of print]

IYENGAR YOGA VERSUS ENHANCED USUAL CARE ON BLOOD PRESSURE IN PATIENTS WITH PREHYPERTENSION TO STAGE I HYPERTENSION: A RANDOMIZED CONTROLLED TRIAL.

Cohen DL, Bloedon LT, Rothman RL, Farrar JT, Galantino ML, Volger S, Mayor C, Szapary PO, Townsend RR.

The prevalence of prehypertension and Stage 1 hypertension continues to increase despite being amenable to non-pharmacologic interventions. Iyengar yoga (IY) has been purported to reduce blood pressure (BP) though evidence from randomized trials is lacking. We conducted a randomized controlled trial to assess the effects of 12 weeks of IY versus enhanced usual care (EUC) (based on individual dietary adjustment) on 24-h ambulatory BP in yoga-naïve adults with untreated prehypertension or Stage 1 hypertension. In total, 26 and 31 subjects in the IY and EUC arms, respectively, completed the study. There were no differences in BP between the groups at 6 and 12 weeks. In the EUC group, 24-h systolic BP (SBP), diastolic BP (DBP) and mean arterial pressure (MAP) significantly decreased by 5, 3 and 3 mmHg, respectively, from baseline at 6 weeks ($P < 0.05$), but were no longer significant at 12 weeks. In the IY group, 24 h SBP was reduced by 6 mmHg at 12 weeks compared to baseline ($P = 0.05$). 24 h DBP ($P < 0.01$) and MAP ($P < 0.05$) decreased significantly each by 5 mmHg. No differences were observed in catecholamine or cortisol metabolism to explain the decrease in BP in the IY group at 12 weeks. Twelve weeks of IY produces clinically meaningful improvements in 24 h SBP and DBP. Larger studies are needed to establish the long term efficacy, acceptability, utility and potential mechanisms of IY to control BP.

Compiled and edited by Dr Ananda Balayogi Bhavanani (Programme Coordinator), Dr Zeena Sanjay (Senior Research Fellow)

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