ORIGINAL ARTICLE

EFFECTS OF INTEGRATED APPROACH OF YOGA (IAY) ON ESSENTIAL HYPERTENSION
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ABSTRACT: The present study was designed to find out the effects of Integrated Approach of Yoga (IAY) on Essential Hypertension in a sample of 120 subjects from Cardiology OPD of AIIMS, Bhubaneswar in the age group of 21 years to 65 years divided into Experimental group and Control group 60 in each. The Experimental group was exposed to regular yogic practice of 1 hour 15 minutes per day in morning for a period of 3 weeks. The Control group was not exposed to any yogic exercises, rather they were advised a regular morning walk 30 minutes per day 5 days a week for a period of 3 weeks. The pre and post readings on subjective and objective parameters before and after the training programme were noted for both the groups. The study showed that the experimental group showed a significant reduction in blood pressure (Systolic and diastolic), pulse rate, respiration rate, BMI and Hamilton Anxiety Rating Scale (HAR) (p<0.01), however the Control group failed to achieve it.

KEYWORDS: Yoga, Essential Hypertension, Experimental group, Control group, Morning walk, Paired “t” test.

INTRODUCTION: India is currently experiencing a rapid epidemiological transition from communicable to non-communicable diseases. Rapid industrialization with subsequent rise in standard of living, obesity, stress, sedentary lifestyle, addiction etc. are posing a growing concern to the health of nation in terms of diseases like obesity, diabetes, hypertension, restrictive lung diseases and cardiovascular morbidities.¹ Hypertension is one of many psychosomatic diseases which can be treated through a combination of yoga and other traditional medicines in addition to drug therapy. The root cause of all the diseases is same: ignorance of our true nature and lack of awareness makes us suffer from these modalities like hypertension.²

REVIEW OF LITERATURE: Global burden of hypertension (HTN) in general is estimated to be as high as 15 to 20% (Braunwald) with minimal elevation in many,³⁴ with essential hypertension being most prevalent.⁵ Usefulness of yoga as an add on treatment in management in hypertension, when compared to conventional treatment and biofeedback was evident since 1975 by Chandra et.al.⁶ Mc Caffrey et.al demonstrated after eight weeks of yoga therapy, the mean blood pressure decreased from 160/98mmHg to 136/81mmHg.⁷ Asana make people more relaxed and decreases blood pressure demonstrated by Pasek et al.⁸ Saraswati et al demonstrated that practice of Śavasana decreased mean blood pressure from 132 to 107mmHg with decrease in drug requirement by an average 68%.⁹ Yoga can significantly reduce weight, blood sugar, cholesterol and blood pressure.¹⁰ Meditators tend to have lower blood pressure.¹¹ Yoga practitioners tend to gain less weight as compared to non-practitioners.¹²¹³¹⁴ A small randomised controlled trial of Sahaja yoga on depressive disorders showed depression scores...
reduced more in the yoga group. In a study of yoga’s effects on distress symptoms in the survivors of 2005 Tsunami; fear, anxiety, sadness and disturbed sleep decreased significantly among them along with heart rate.[15] Sudarsan Kriya Yoga and comprehensive yogic breathing program decreases stress, anxiety and depression.[16][17]

**OBJECTIVE:** The objectives of the study are to assess the effects of IAY on blood pressure levels (Systolic & diastolic) pulse rate, breath rate, BMI, and HAR through statistical analysis, sequence plots and bar diagrams on the subjects of Experimental and Control groups. The specific objectives and hypotheses of the present study are as follows:

1. To explore the data statistically and compute different statistical measures, such as mean, standard deviation, minimum, maximum, range etc. for the experimental and control groups.
2. To study if there is a significant reduction of systolic blood pressure, diastolic blood pressure, pulse rate, breath rate, BMI, and HAR after the intervention of yoga in the Experimental and Control groups.
3. To identify the parameters showing significant correlations on the Experimental and Control group through correlation analysis.
4. To build up regression models for the parameters showing significant correlation.
5. To study the effects of IAY on experimental and control groups through sequence charts and bar diagrams.

**METHODOLOGY:** To achieve the purpose of the study, 120 subjects attending the Cardiology OPD of AIIMS, Bhubaneswar between 21-65 years were randomly selected. The subjects were divided in to 2 groups such as the Experimental group and the Control group comprising of 60 subjects in each. The Experimental group underwent a regular yogic practice of 1 hour 15 minutes per day in the morning for a period of 3 weeks. The yogic intervention for Experimental group included asanas like Pawanamuktasana series, Tadasana, Tiriyakatadasana, Katicakrasana, Vajrasana, Sasankasana and Pranayama techniques. Pawanamuktasana series included toes bending, ankle bending, ankle crank (Rotation), knee bending, purnatitali (Butterfly) asana, Mustikabandhana (Finger stretching), wrist bending, elbow bending, shoulder and neck rotation. In Tadasana, Tiriyakatadasana, Katicakrasana (TTK) entire body is extended, stretched up and it relaxes the arteries. In Vajrasana and Sasankasana, knees are bent below the thighs and spine is extended which brings peace in mind and brings down the sympathetic drive. The golden Pranayama techniques used in this study included Nadishodhana, Sitali and Bhramari. Nadishodhana which means alternate nostril breathing practice brings down the central sympathetic drive. Sitali which means inhalation through mouth and exhalation through both the nostrils calms the mind, decreases the sympathetic drive and renin angiotensin surge. Bhramari which means producing humming sound like a bee impacts the cardiovascular system as music does.

Apart from that, Yoga nidra in which patient lies down in sound sleep quietly being away from the surrounding surge the parasympathetic and calm down the sympathetic and Mahamrityunjay mantra were also practiced. The subjects of Control group were not exposed to yoga rather did morning walk of 1 hour 15 minutes (Early morning) every day for 3 weeks. The
parameters under study were measured before and after the intervention of Yoga and practices of morning walk for the Experimental and the Control group respectively. The objective parameters such as systolic blood pressure and diastolic blood pressure measured by sphygmomanometer, pulse rate (Beats/minutes), respiration rate (Cycles/minute). The BMI (Body Mass Index) was computed by using the formula BMI = \frac{\text{weight (kg)}}{\text{height (m)}^2}.

The anxiety was measured by questionnaire called “Hamilton Anxiety Rating Scale” (HAR). Paired ’t’ test was used to compare the results of pre and post IAY on systolic and diastolic blood pressure, heart rate, respiration and BMI. p<0.05 was considered to be significant.

| Name of the Practices | Frequency | Duration | Total Time |
|------------------------|-----------|----------|------------|
| Asana                  | Pawanamuktasana series I 1. Toes bending 2. Ankle Bending 3. Ankle Crank 4. Knee Bending 5. Purnatitali asana 6. Mustikabandhana 7. Wrist Bending 8. Elbow Bending 9. Shoulder rotation 10. Neck rotation | 3 weeks | 10 rounds each | 15mins |
| Standing Group         | 1. Tadasana 2. Tiriyaka Tadasana 3. Katicakrasana | 3 weeks | 10 rounds each | 10mins |
| Vajrasana Group        | 1. Vajrasana 2. Sasankasana | 3 weeks | 2.5mins each | 5mins |
| Relaxation Group       | Savasana | 3 weeks | 1mins | 3mins |
| Pranayama              | 1. Nadisodhana 2. Sitali 3. Bhramari | 3 weeks | 3.5mins each | 10mins |
| Relaxation             | Yoganidra | 3 weeks | 20mins | 20mins |
| Mantra                 | Mahamrtyunjaya | 3 weeks | 27 rounds | 10mins |

**Intervention for Control Group:** The control group was advised to do morning walk only for 3 weeks. They were not practicing any yoga, aerobics or any physical exercises.

**RESULTS AND DISCUSSION:** The data so collected were analyzed by using the statistical software SPSS 16.0 under Windows XP environment.
| Variable (Parameters) | Number(N) | Experimental Group | Control Group |
|----------------------|-----------|---------------------|---------------|
|                      | Range     | Mean ±S.D           | Range         | Mean±SD       |
|                      | Min       | Max                 | Min           | Max           |
|                      |           |                     |               |               |
| Age                  | 60        | 21-61               | 21            | 65            | 45.38±3.18    |
| Sys(pre)             | 60        | 124-196             | 120           | 170           | 139.17±10.153 |
| Sys(post)            | 60        | 110-180             | 120           | 170           | 138.70±10.237 |
| Dia(pre)             | 60        | 90-110              | 90            | 150           | 94.87±9.112   |
| Dia(post)            | 60        | 70-100              | 88            | 100           | 92.50±3.908   |
| BMI(pre)             | 60        | 18-34               | 14            | 23            | 20.62±4.322   |
| BMI(post)            | 60        | 18-32               | 15            | 30            | 20.57±4.208   |
| Pulse(Pre)           | 60        | 70-100              | 88            | 90            | 79.93±13.108  |
| Pulse(post)          | 60        | 70-92               | 75            | 90            | 81.78±3.622   |
| BR(pre)              | 60        | 14-27               | 14            | 23            | 17.65±2.065   |
| BR(post)             | 60        | 13-24               | 12            | 24            | 17.15±2.711   |
| HAR(Pre)             | 60        | 16-30               | 17            | 30            | 23.43±3.770   |
| HAR(POST)            | 60        | 12-30               | 15            | 30            | 23±3.849      |

Table 1. Descriptive Statistics for the Experimental and Control Groups

Paired t-test: To examine if intervention of IAY and morning walk have significant effect on both objective and subjective parameters, of Experimental and Control group, a paired t test was conducted for both the groups and the result is depicted in table 2.

| Experimental group | Variable Pair       | N  | Mean | SD   | “t”  | df | P-value |
|--------------------|---------------------|----|------|------|------|----|---------|
| Control group      | Sys(pre)-Sys(post)  | 60 | 0.467| 3.022| 1.196| 59 | 0.236   |
| Experimental group | Dia(pre)-Dia (post)| 60 | 2.367| 8.328| 2.201| 59 | 0.256   |
| Control group      | BMI(pre)-BMI(post)  | 60 | 0.500| 0.982| 0.395| 59 | 0.695   |
| Experimental group | Pulse(pre)-Pulse (post) | 60 | 3.317| 2.281| 11.263| 59 | 0.000   |
| Control group      | Resp rate(pre)-Resp rate (post) | 60 | 1.850| 11.764| 11.263| 59 | 0.000   |
| Experimental group | Resp rate(pre)-Resp rate(post) | 60 | 0.500| 1.384| 2.299| 59 | 0.007   |
| Control group      | HARS(pre)-HARS (post) | 60 | 4.550| 1.808| 19.494| 59 | 0.000   |

Table 2
As the “p” value of Experimental group is highly significant (p<0.01), thus it may be inferred that intervention of IAY has significant effect in the reduction of systolic blood pressure, diastolic blood pressure, heart rate, respiration rate and BMI in the Experimental group. Similarly we found that “p” value is insignificant (p>0.05) for control group, thus it may be inferred that there would be no significant reduction of systolic blood pressure, diastolic blood pressure, heart rate, respiration rate and BMI after the morning walk in the control group.

The sequence of changes in the objective and subjective parameters for the experimental and control group after intervention yoga and morning walk respectively are presented through the following sequence plots.

**SEQUENCE PLOT:**

(Experimental group)
(Control group)

(Experimental group)
From the above two plots it is seen that the graphs for systolic and diastolic blood pressure in the Experimental group after the intervention of IAY (Green colored line) runs below that of before intervention of yoga (Velvet colour line).

From above two plots it is seen that the graphs for the systolic and diastolic blood pressure for the Control group after the intervention of morning walk (Green coloured line) do not run below that of before morning walk (Velvet colored line).

**SEQUENCE PLOT:**

(Experimental group)
(Control group)

![Control group BMI chart]

(Experimental group)

![Experimental group Pulse Rate chart]
From the above sequence plots it is evident that graphs for BMI and pulse rate in Experimental Group after yoga therapy (green colored line) run below the graph indicative of before yoga therapy.

From the above sequence plots it is evident that graphs for BMI and pulse rate in Control Group after morning walk (green colored line) run at the same level with the graph indicative of before morning walk (velvet colored line).

**SEQUENCE PLOT: (Experimental group)**
(Control group)

(Control group)

(Experimental group)
From the above plots we find that the sequence plots for respiration rate and HAR in the experimental group after yoga (Green colored line) constantly runs below the plot for that of before yoga (Velvet colored line).

From the above plot we find that the sequence plots for respiration rate and HAR in the control group after morning walk (Green colored line) constantly runs at the same level with the plot for that of before morning walk (Velvet colored line).

From the above sequential plots it is evident that yoga therapy decreases the systolic and diastolic blood pressure, heart rate, respiration, BMI and HAR while simple morning walk fails to do so.
From figure no.1 it is evident that there has been a significant reduction in the mean values of systolic blood pressure, diastolic blood pressure, pulse rate, BMI, breath rate after the intervention of IAY. Thus it may be inferred that IAY has significant effect in reducing blood pressure levels, pulse rate, breath rate, BMI and HARs in the Experimental group.

![Figure no. 2: Control Group(Before & After Morning Walk)](chart)

However from figure no.2 above it is found that there has been no significant reduction in the mean values of all parameters such as systolic blood pressure, pulse rate, BMI, breath rate, HARs after the morning walk for the control group. Thus the very objectives of the study are justified through statistical analysis, sequence plot and bar diagram.

Yoga is more beneficial than simple exercise; a simple statement can justify it; 'yoga is the physiologic exercise'. Its principle varies across organs and physiologic needs. The above mentioned yogic techniques bring down the sympathetic surge, drop down the cardiotoxic neurohormones, relax the vessel wall, reverse the adiposity and finally transmit it into the decrease in blood pressure. Pranayam, the God practiced Yoga is believed to halt the vascular senescence, keep the persons live long and healthier. American Heart Association advocates 150 min exercise programme per week to have a healthy heart. Exercise pours down nitric oxide (NO) into blood, the golden molecule that preserves vasomotion. Therefore it is the time for awareness of practicing physiologic exercise i.e. yoga therapy. Regular exercise builds up the vagal tone, keep the heart rate quite low and decrease the vascular resistance. The need of various techniques as described above are justified as each has unique influence on vasomotor tone and cardiac performance that would combinedly translate into decrease in blood pressure. European Society of Cardiology recommends life style modification (LSM) as a powerful initial strategy to reduce blood pressure; we can add simple yoga therapy in the LSM to bring down our vascular tragedy.

Even non therapeutic interventions can decrease blood pressure up to 30mmHg i.e. exercise by 6-8 mmHg, salt restriction by 2-4mmHg, decreasing blood pressure by 1mm Hg per 1 kg reduction of body wt, being away from alcohol and nicotine by 5mmHg, fruits and fiber rich diet by2-4mmHg. Our study delineated decrease in SBP and DBP by around 10mmHg. It is a lesson from hypertension clinics that increase in blood pressure by 20/10mmHg increases the cardiac mortality by 2 fold, hence it is an accepted fact that practicing yoga therapy and decreasing BP by 10mmHg can translate into a huge mortality benefit. When we ask for evidence people call for scientific evidence; if at all we want to advocate exercise why it is not age old, proved and scientific exercise- the yoga therapy. Simple exercise can make organs healthy but it
is yoga therapy that makes organs happy and healthy together. Pranayama is the yogic exercise that the sick cardiacs can even practice. As evidenced in our study yogic practice decreases the heart rate and respiration, the integral part of cardio respiratory rehabilitation as heart rate and respiration runs in the symbiosis of 1:4 ratio. Yoganidra cools down the sympathetic surge, makes our heart beat slower and decreases our anxiety parameters as person undergoes a sound sleep away from surrounding in Yoganidra practice. The Vedic Mahamrityunjay mantra has unique sedating effect on autonomic madness that turns the heart beat slower, steadier and longer.

Today pills are many but we should look in the pockets of our ancestry who have left the golden practice of Yoga. A pill has a limited half-life but the half-life of regular yogic practice is undetermined, it gets embedded in our vaso and cardio tonic genes just like the Pavlov’s conditioned reflex of ringing bell for food. The basis of all Asanas is that it decreases the venous return, the preload and the Frank Starling law operates at low end diastolic volume generating low systolic blood pressure, pours the vasodilators, decreases the vascular tone and decreases the DBP, enhances the endurance and the vagal tone decreasing heart rate and respiration, burns the adipose tissue consuming much ATP and thereby decreasing BMI and keeping people happy by releasing Anandamide, the molecule of happiness in brain.

CONCLUSION: Yoga is the ancient science practiced and advocated since ages and years together to keep people healthy and live long. Our study, a small one to evaluate its effects in treating hypertension besides modifying physiologic parameters achieved paramount success. Although American Heart Association recommends 150 min exercise programme per week to have a healthy heart, our study achieved superiority of yogic practice to that of regular morning walk in achieving a better cardiovascular profile. In the beginning of the International Yoga Day we should come forward to encourage regular yogic practice to beat our heart longer with a happy smile.

REFERENCES:
1. Kishore J. National health programs of India. 7th Ed, Chap.1, Century publication, New Delhi, 2007; 1-3.
2. Shasnkardevananda S.S. (1998), the effect of Yoga on Hypertension, Bihar School of Yoga, Munger, Bihar.
3. Braunwald E. Heart Disease, A text book of Cardiovascular Medicine, 5th edition.
4. Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton P.K, He J (2005).” Global burden of hypertension: analysis of world wide data”. Lancet 365 (9455):217-23. doi: 10.1016/ so 140-6736(05) 17741-1. PMID 15652604.
5. Carretero, OA, Oparil, S. “Essential Hypertension. Part I: definition and etiology”. Circulation 101(3):329-35.PMID10645931.
6. McCaffrey, R., Ruknui P., Hatthakit U., Kasetsomboon P. (2005). The effects of yoga on hypertensive persons in Thailand. Holistic Nursing Practices, 19(4), 173-180.
7. Caffery MC, K.S Gopal et al. Effect of Yoga on essential hypertension, Journal of Natural science and Biology,34(5), p.9-12.
8. Patel C, North W. Randomized control trial of yoga and biofeedback in management of hypertension. Lancet, 2(7925): 93-95.
9. Satyananda S.S. Kundalini Tantra, Yoga Publication Trust, Ganga Darsan, Munger, Bihar.
10. Yang K. (2007). A review of yoga programs for four leading risk factors of chronic disease. Evidence-based Complementary and Alternative Medicine, 4(4), 487-491.
11. Wallace R.K, Benson H, Wilson A.F. ‘A Wakeful Hypometabolic Physiologic State’, American Journal of Physiology, Vol. 2221, no. 3, September 1971, pp. 795-799.
12. Kristal AR, Littman AJ, Benitez D, White E. Yoga Practice is associated with attenuated weight gain in healthy middle aged men and women. Altern. Ther Health Med 2005; 11:28-33.
13. Shantaram S. Beneficial Effect of Yoga on Coronary artery Disease, Yoga Vijnana (The Science of Yoga), New Delhi.
14. Sharma V.K, Das S, Mondal S, Goswami V, Gandhi A. Effect of Sahaja Yoga on depressive disorders Indian J physiol pharmacol 2005; 49: 462-8.
15. Telles S, Naveen KV, Mang D. Yoga reduces symptoms of distress in tsunami survivors in the Andamn islands. Evid based complement Alternat Med 2007; 4:503-9.
16. Brown RP, Patricial LG. Sudarsan Kriya Yogic Breathing in the treatment of Stress, anxiety and depression. Part II- clinical applications and guidelines. J Altern complement Med 2005, 11:711-7.
17. Kjellgren A, Bood SA, Norlander T. Wellness through a comprehensive yogic breathing program a controlled pilot trial BMC Complement Altern Med 2007; 7:43.