TO STUDY THE SAFETY AND USEFULNESS OF ADDING *LAGHU ŚANKHAPRAKŚĀLANA* TO THE INTEGRATED APPROACH OF *YOGA* THERAPY IN PATIENTS WITH ESSENTIAL HYPERTENSION.

Dissertations submitted by

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Towards the partial fulfillment of
Doctor of Medicine In Yoga & Rehabilitation
MD (Y&R)

To
S-VYASA

SWĀMĪVIVEKĀNANDA YOGA ANUSANDHĀNASAMSTHĀNA

(DECLARED AS DEEMED UNIVERSITY UNDER SECTION 3 OF THE UGC ACT, 1956)

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CERTIFICATE

This is to certify that Dr. Prakash Mashyal who registered for the degree of MD (Y&R) with effect from August 12, 2010, at *Swāmi Vivekānanda Yoga Anusandhāna Saṁsthana* University (SVYASA) under the Division of *Yoga* and Life Sciences, has successfully completed the required 'training' in acquiring the relevant knowledge of *yoga* therapy and rehabilitation and has successfully carried out the research project titled "To study the safety and usefulness of adding *laghu śankhaprakśālana* to the integrated approach of *yoga* therapy in patients with essential hypertension" in partial fulfillment of the course as per the regulation of the University.

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A C K N O W L E D G E M E N T

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I am indebted to my parents for their love and support.

Place: S-VYASA.

Dr. Prakash Mashyal

STANDARD INTERNATIONAL CODE

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TITLE

ABSTRACT

To study the safety and usefulness of adding *laghu śankhaprakśālana* to the integrated approach of *yoga* therapy in patients with essential hypertension.

Background:

There are several studies that have documented the usefulness of different types of *yoga* practices (*pranāyamas, shavāsana* and meditations) in the management of mild and moderate hypertension. Our pilot studies and clinical observations on patients who are admitted to the residential and/or out-patient centers of SVYSA also had shown beneficial effects of integrated approach to *yoga* therapy (IAYT). *Yoga* and *āyurveda* texts emphasize the role of clearing the bowel as a very important component in the management of hypertension. For this, they recommend a *yoga* technique called *shankhaprakshālana.* In our clinical pilot studies at the center we tried to incorporate this to see the add-on effects. But this was not acceptable either to the clinicians or the patients because of the effort involved in the practice. Hence the *laghu śankhaprakśālana kriyā* evolved and recommended by Bihar School of *Yoga* was tried with encouraging results. Also, *āyurveda* recommends the use of a mild herbal laxative for clearing the bowel. Hence the present well planned self as control pilot study was undertaken.

Objectives:

1. To study to check the safety and utility of LSP in the management of mild to moderate hypertension.
2. To study the effect of LSP *triphalā*.

Objective: The aims of the study were (1) To study safety and effect of *laghu śankhaprakśālana* on blood pressure in hypertensive patients, (2) To study the safety effect of *Triphalā laghu śankhaprakśālana* on blood pressure in hypertensive patients, (3) To compare the effect of *Triphalā laghu śankhaprakśalana* (Trp.LSP) with *laghu śankhaprakśalana* (LSP) with Luke warm water on blood pressure in hypertensive patients.

Materials and Methods: This randomized self as control study recruited 32 essential hypertensive participants (mild to moderate degree) admitted for a week for a residential integrated *yoga* therapy program at *ārogyadhāma* of S-VYASA University in Bengaluru, India, after taking signed informed consent. They all had a daily routine of about in 6 hours of integrated *yoga* module

for hypertension that included physical postures, relaxation sessions, *prānāyama*, meditations (three types) along with lectures and discussion on the philosophical aspects of life style suggestions from *yoga* texts. They were also taught a *yogic* bowel cleansing technique called *laghu śankhaprakśālanakriyā* (LSP) individually by the research team. Primary variables (blood pressure and pulse rate) were assessed before and immediately after the practice of two sessions of LSP (LSP with plain water and LSP with *triphalā* water) on the 2nd and 5th day after admission by using randomization table to randomize the two days. Secondary variables were assessed on 1st and 6th day of their stay in *ārogyadhāma.*

Results: There was a significant ($p<0.001$) reduction in Pulse rate, Systolic and Diastolic blood pressure immediately after both types of LSP with non-significant difference between the two sessions ($p<0.505$). There was significantly ($p<0.001$) more number of stools after LSP with *triphalā* water than LSP with plain water.

Results of secondary variables after one week of intervention showed significant reduction in BMI ($p<0.004$), medications score ($p<0.001$), symptoms score ($P<0.001$), fatigue ($p<0.001$), state and trait anxiety scores (STAI, $P<0.001$) and scores on ill health (GHQ, $p<0.001$) with increase in duration of exhalation time ($p<0.001$), comfort level ($p<0.001$) and quality of sleep ($P<0.001$).

Conclusion: This study provides the first evidence that *laghu śankhaprakśālana kriyā* can be used safely to clear the bowel in patients with mild to moderate essential hypertension. Addition of *triphalā* to the water of LSP provides better cleansing. Also a weeklong practice of specific set of integrated *yoga* program is useful in improving the health of patients with essential hypertension as shown by improvement in both subjective and objective measures.

Key words: Hypertension, *Triphalā laghu śankhaprakśālanan kriyā, yoga*.

CHAPTER 1

INTRODUCTION

Modern style of living might have given man all comforts that he craved for, but in the meantime it has its darker side too; one of them is the increasing prevalence of many lifestyle diseases, Obesity, Diabetes, Hypertension, to mention a few [1], etc.

Hypertension being a chronic illness is one such important public health challenge because of its risk of cardiovascular diseases.

It is clear that hypertension not only increases the morbidity and mortality and decreases the life span by10 to 20 years causing cardiac or renal problems. In spite of increasing public awareness and rapidly expanding array of antihypertensive medications, hypertension remains one of the most frequent risk factors for cardiovascular/ cerebrovascular morbidity and mortality[2]. It is estimated that 1billion people are affected worldwide[3]. In India itself 14 % of people suffer from hypertension[4], and majority of them have essential hypertension. This "silent and salient Killer" drew the attention of WHO and the year 1978 was declared as the "Hypertension year". Being imperative to the health and longevity of man, the study of hypertension continues to be one of the most intellectually stimulating challenges.

As most of the patients suffering from abnormally elevated blood pressure are asymptomatic, diagnosis is either missed or delayed. As there is no definitive definition universally accepted, the Joint National Committee (JNC-4) of the United States for detection, evaluation and treatment of high blood pressure defines Hypertension as resting systolic blood pressure (SBP) ≥140 mm Hg and a diastolic blood pressure (DBP) ≥ 90 mm Hg in middle aged persons (35-50) Key messages of the 7th report of the JNC on prevention, detection, evaluation and treatment of HTN are[3],

- In those older than 50 years SBP of >140 mm of Hg is a more important Cardiovascular risk factor than the diastolic blood pressure.
- Beginning at 115/75 mm Hg CVD risk doubles for each increase of 20/10 mm of Hg.
- Pre HTN individuals require health promoting lifestyle modifications to prevent a progressive rise in blood pressure.

1. PREVALENCE OF NON COMMUNICABLE DISEASES (NCDs):

The World Health Organization (WHO) reports NCDs to be by far the leading cause of mortality in the world, representing over 60% of all deaths. Out of 36 million people who died from

NCDs in 2005, half were under the age of 70 years and half were women. Of the 57 million global deaths in 2008, 36 million were due to NCDs[5]. Contributing to approximately 63% of total deaths worldwide. Risk factors such as a person's background, lifestyle and environment are known to increase the likelihood of NCDs. Every year, at least 5 million people die because of tobacco use and about 2.8 million die from being overweight. High cholesterol accounts for roughly 2.6 million deaths and 7.5 million die because of high blood pressure. By 2030, deaths due to chronic NCDs are expected to increase to 52 million per year while deaths caused by infectious diseases, maternal and parental conditions and nutritional deficiencies are expected to decline by 7 million per year during the same period. There has been an increased focus on non-communicable diseases (NCDs) in India, particularly on cardiovascular diseases and associated risk factors. It is now clear that cardiovascular risk factors (CVRF) and cardiovascular diseases (CVD) are no longer restricted to the economically advantaged groups but are an increasing burden among the poor in India, as reported a comprehensive review of studies looking at the association between socioeconomic status (SES) and CVRF, CVD, & CVD-related death rate in India. With the exception of smoking and low fruit and vegetable intake, the studies clearly suggest that CVRF/CVD is more prevalent among high SES groups in India than among lower SES groups. Although CVD-related death rates appear to be higher among the lower SES groups, the proportion of deaths from CVD-related subjects were found to be greater among higher SES groups. The studies on SES and CVRF/CVD also reveal a substantial discrepancy between the information presented and the authors' interpretations and conclusions, there seems to be an unsubstantiated claim that a reversal in the positive SES-CVRF/CVD association has occurred or is occurring in India[6].

1.1. HYPERTENSION (HTN):

1.1.1. PREVALENCE OF HYPERTENSION

WHO has estimated that High blood pressure contributes to 1 in every 8 deaths, making HTN the third leading killer in the world. Globally there are one billion hypertensives and 7.1 million people die as a direct impact of HTN every year[6].

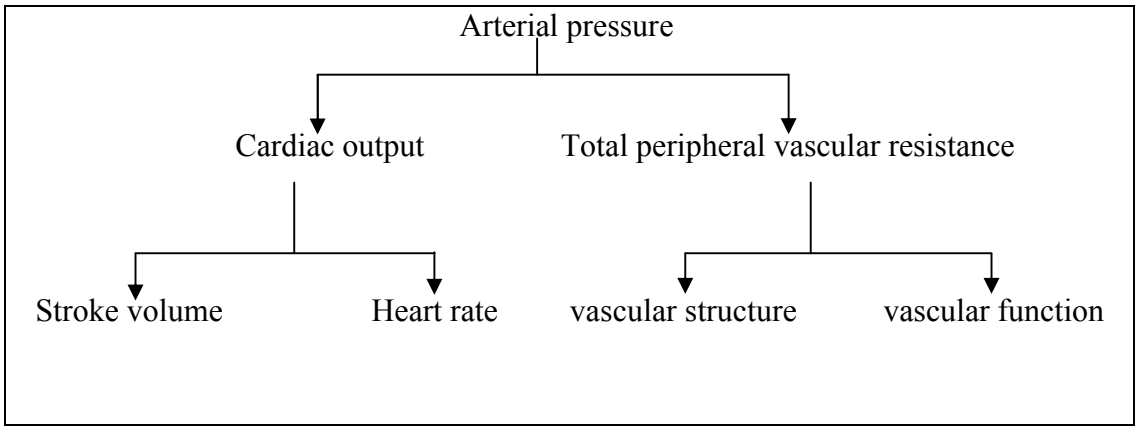
According to a recent survey in USA about 1 in 3 adults have High blood pressure. World hypertension league recognized that more than 50% of hypertensive populations are unaware of this condition[7]. The prevalence dramatically increases in patients older than 60 years. In many countries, 50% of individuals in this age group have HTN. And in females the prevalence is closely related with age, with a substantial increase occurring after age 50.

Community surveys carried out in India in different geographical locations, often with small population samples have reported prevalence rate of 10% in rural and 25% in urban population[6]. Increasing HTN in India is related to adiposity levels. HTN is directly responsible for 57% of all stroke deaths and 24% of all CHD deaths in India.

1.1.2. DEFINITION

Arterial blood pressure is defined by the following equation [Guyton, Textbook of physiology]:

Arterial pressure =cardiac output * total peripheral vascular resistance[8].



Schematic diagram showing blood pressure

Cardiac output and peripheral resistance are the two determinants of arterial pressure. The cardiac output is determined by stroke volume and heart rate; stroke volume is related to myocardial contractility and to the size of the vascular compartment.

Peripheral resistance is determined by functional and anatomical changes in small arteries and arterioles. A persistent increase in this arterial pressure even when a person is at rest is hypertension. Essential Hypertension is the term applied to 95% of cases in which no organic cause for hypertension can be identified.

1.1.3. CLASSIFICATION OF HYPERTENSION[9]

A. Primary or essential hypertension in which the cause for the increase in blood pressure is unknown and is related to lifestyle with a genetic background. Essential hypertension constitutes about 90-95% patients of hypertension.

B. Diseases of the kidneys, endocrines or some other organs cause secondary hypertension, in which the blood pressure is increased. Secondary hypertension comprises 5-10% cases of hypertension.

1.1.4. CLINICAL CLASSIFICATION OF HYPERTENSION[10]

Hypertension has been classified based on resting blood pressure values as follows.

About 90-95% patients of hypertension have benign hypertension that falls within the range of mild to severe HTN.

Category	Systolic (mm Hg)	Diastolic (mm Hg)
Normal BP	<130	<85
High normal BP	130-139	85-89
HTN (stage1) Mild	140-159	90-99
HTN (stage2) Moderate	160-179	100-109
HTN (stage3) Severe	180-209	110-119
HTN (stage4) Very severe	>210	>120
Malignant HTN	>200	>140

Table.1. Classification of Hypertension

1.1.5. CLINICAL FEATURES[11]

Hypertension is asymptomatic in most people. Hence even the clinical diagnosis is based on routine blood pressure recording and not based on symptoms. The symptoms that may be found are:

1. Headache
2. Dizziness
3. Nausea
4. Anxiety
5. Palpitation
6. Insomnia
7. Pallor
8. Shortness of breath
9. Chest pain
10. Tremors
11. Fatigue
12. Vomiting

1.1.6. COMPLICATIONS OF HYPERTENSION[10]

Heart:

Left ventricular hypertrophy, Hypertensive cardiomyopathy, and Myocardial infarction, are the complication. Hypertensive heart disease are the result of structural and functional adaptations leading to left ventricular hypertrophy diastolic dysfunction, CHF, abnormalities of blood flow due to atherosclerotic coronary artery disease and microvascular disease, and cardiac arrhythmias.

Brain:

Hypertension is an important risk factor for brain infarction and hemorrhage. Approximately 85% of strokes are due to infection and the remainders are due to hemorrhage, either intra cerebral hemorrhage or subarachnoid hemorrhage. The incidence of stroke rises progressively with increasing blood pressure levels, particularly systolic blood pressure in individuals >65 years. Treatment of hypertension convincingly decreases the incidence of both ischemic and hemorrhagic strokes.

Kidney:

Hypertension is a risk factor for renal injury and ESRD. Renal risk appears to be more closely related to systolic than to diastolic blood pressure, and black men are at greater risk than white men for developing ESRD at every level of blood pressure.

Eye:

Hypertensive retinopathy is a condition characterized by a spectrum of retinal vascular signs in people with pressure. The retinal circulation undergoes a series of pathophysiological changes in response to elevated blood pressure. In the initial, vasoconstrictive stage, there is vasospasm and an increase in retinal arteriolar tone owing to local autoregulatory mechanisms. This stage sees clinically as a generalized narrowing of the retinal arterioles. Persistently elevated blood pressure leads to intimal thickening, hyperplasia of the media wall, and hyaline degeneration in the subsequent stages.

1.1.7. DIFFERENTIAL DIAGNOSIS[12]

Factors	Essential HTN	Secondary HTN
Etiology	Unknown	Renal disease, vascular disease, endocrine disease, drug induced
History	Strong family history of HTN along with repeated finding of intermittent pressure elevation	Often develops before the age of 35 or after 55. History of use of steroids or estrogens is of obvious significance
Pathology	Pathogenesis not clearly understood	Pathogenesis depend on the disease that had caused HTN
BP recording	Rise in BP when the patient goes from the supine to the standing position	Treatment of the primary diseases, reduces the Blood pressure
Symptomatic	Symptomatic /asymptomatic vague symptom like headache, vertigo easy fatigability etc., will be present	Symptoms of underlying disease
Investigation	No specific investigation is diagnostic	Depending upon the underlying disease
Prognosis	Not bad, when benign and is controllable with regular medication	Depends upon the primary disease
Treatment	Non drug therapy, Reduced salt intake, Regular exercise, Weight reduction, avoiding risk factors Drug therapy Diuretics Antiadrenergic agents Vasodilator Calcium channel blocker ACE inhibitors ACE receptor antagonists	Depends upon the cause and requires drug therapy during severe conditions

Table.2. Showing differential diagnosis

1.1.8. CAUSES OF HTN

1.1.8.1. *LIFESTYLE*

Sedentary lifestyle[13]*:*

People who have a sedentary lifestyle without regular physical activity are more prone to have NCD's, especially the cardiovascular diseases. Several population studies have suggested that individuals who undertake regular physical exercises have lower blood pressure than sedentary individuals. Although it is known that dynamic exercise raises the blood pressure and isometric exercise raises it a lot more, there is good evidence that people who take regular exercise are healthier and have lower BP than those who take none.

Obesity and weight[14]*:*

There is direct relationship between weight and BP. For every 10% increase in weight a rise 6.5mm of Hg in systolic blood pressure was observed in Framingham study. There is a strong link between excess body fat, blood pressure levels and prevalence of Hypertension as obesity contributes to blood lipid abnormalities and impaired glucose tolerance, it has particular significance as a factor underlying the increased prevalence of coronary artery disease in hypertensive patients.

The association of obesity and Hypertension manifests in three different ways -

- **Over weight** is more prevalent in Hypertensive than in Normotensives individuals
- **Normotensives obese** subjects are more likely to become Hypertensive.
- **Hypertensive subjects** are at increased risk of becoming over weight, compared to normotensives individuals.

Smoking[15]*:*

Nicotine and carbon monoxide are the two major product of tobacco combustion are both potent vasoconstrictors. Tobacco smoking has been reported to cause acute rise of blood pressure but whether prolonged smoking leads to substantial Hypertension has not been established. Medical research council observed that the incidence of stroke and coronary heart disease in hypertensive patients who smoke is 2 or 3 times greater than in non-smoking patients with comparable blood pressure. It affects both the central and peripheral nervous system. This may contribute as a risk factor to HTN.

Alcohol intake[16]*:*

Several studies have shown a strong and independent relationship between alcohol intake and blood pressure. It has been estimated that about 10% of hypertensive have alcohol induced Hypertension. The alcohol hypertensive relationship still remains the subject of future research, particularly as no convincing mechanism can yet be identified.

Stress[17]*:*

Acutely stressful stimuli have a high chance of raising blood pressure and may be more in subjects who have familial Hypertension. Sustained or repeated emotional stress (anger, frustration, envy, hatred, fear and worry) causes arteriolar contraction through an outpouring of norepinephrine from the sympathetic vasomotor nerve endings and epinephrine from the adrenal medulla.

It is probable that some of these persons have inherited abnormalities of increased reactivity of sympathetic nerve ending to emotional sensory stress, and or increased reactivity of their arteriolar smooth muscles to norepinephrine and epinephrine.

White coat Hypertension[18]*:*

In White coat Hypertension the blood pressure rises in the presence of a doctor, this is possible due to temporary emotional stress; the over activity of the sympathetic nervous system has an important part to play in the pathogenesis of Hypertension.

Sleep abnormalities[19]*:*

Sleep causes a fall in blood pressure and lack of sleep increase blood pressure, however sleep associated with nightmare, dreams may also cause a rise in Blood pressure.

1.1.8.2. GENETIC FACTORS[20]

Numerous common genetic variants with small effects on blood pressure have been identified.

The evidences in support are,

- The familial aggregation: Hypertension is more frequent in some communities and families than others. It has been estimated that if both parents have hypertension, the incidence of HTN in children is more than the others.
- Epidemiologic data: Occurrence of HTN in twins.
- Identification of HTN susceptibility gene: Many genes have been pinpointed during experimental studies, which are implicated in the causation of essential HTN. These are rennin gene, the ANP receptor gene, 11-B hydroxyl's gene.

1.1.8.3. ASSOCIATED FACTORS[21]

Age[22]

Older people tend to have higher Blood pressure than young people. Studies have demonstrated that blood pressure rises with advancing age, because of characteristic changes of aorta and large arteries. Due to thickening of the vessel wall, arteriosclerosis, an increase in sub-endothelial layer and the media, which show increased collagen content, elastic fragmentation and calcification leads to decreased elasticity in the lumen of vessels as a result blood pressure, is raised.

In older people the average diastolic blood pressure tends to lower, although their systolic blood pressure may continue to rise. This may be due to clinical or sub clinical cardiac damage leading to a reduction of cardiac output.

Most cases of high blood pressure are diagnosed in men, until the age of 45. From age 45-54 men and women are equally at risk of high BP, after the age of 54, women are actually more likely to have high blood pressure than men. Below is the table showing the illustration of the same.

Age	Men (%)	Women (%)
20-34	11.1	6.8
35-44	25.1	19.0
45-54	37.1	35.2
55-64	54.0	53.3
65-74	64.0	69.3
75 and older	66.7	78.5
All	34.1	32.7

Table.3. Prevalence of HTN in Age and Gender Groups

The Framingham study showed an average 20 mmHg and 10 mmHg increase in systolic and diastolic pressures respectively from age 30 to 65yrs. A 20 year follow up showed that the risk of CVD increased with age.

Sex[23]*:*

Though Hypertension affects both the sexes, the incidence is slightly lower in pre-menopausal women, i.e. up to 40yrs. However; after this, females are more prone to Hypertension than men.

Race:

The role of racial factor in the causation of Hypertension in Indian population is not documented.

Salt intake[24]*:*

Communities in which the average salt intake is 3 gm or less per day will have lower average BP; when these people migrate to communities where the daily salt intake is 7 to 8gms, their BP increases proportionately.

When salt is consumed in excess, it cannot remain in crystal form in circulation; rather it holds water which results in increased blood volume, as blood pressure is directly proportional to blood volume, the blood pressure also rises.

Exposure to cold[25]*:*

It causes raise of blood pressure, this is due to hypothalamic stimulation. There is cutaneous vasoconstriction leading to increased resistance to blood flow and elevation of Blood pressure.

Geography[26]*:*

Several studies have shown that high altitude residents have lower Blood pressure. Possible contributing factors include,

i) Lower peripheral resistance due to increased capilarization of tissues.

ii) Hypoxia causing reduced thyroid activity and

iii) Primitive life style conditions without the stresses of modernization.

Diet[27]*:*

It has been found that BP is slightly lower in vegetarian than non-vegetarian population, but it is uncertain why this difference occurs. This has led to the hypothesis that high animal fat diet itself may be related to Hypertension.

Trace metals[28]*:*

It has been claimed that both Cadmium and Lead, which are environmental pollutants, may cause high BP. The main source of Cadmium for the human body is cigarette smoke. Conversely, however there is fairly good evidence that Blood pressure is lower in areas where drinking water is hard i.e. higher Calcium content.

Recent studies have also implicated events in early life (for e.g. low birth weight, maternal smoking and lack of breastfeeding) as risk factors for essential hypertension in adults, although the mechanisms linking these exposures to adult Hypertension remains obscure.

1.1.9. INVESTIGATIONS[13]

Since HTN is an asymptomatic disease, it is recommended that all persons with raised blood pressure have the following investigations check for any complications and associated conditions Routine Blood test.

Routine Blood tests:

Blood routine examination like Hb, TC, DC, and ESR.

Metabolic:

FBS, PPBS, Lipid profile, Thyroid function Test

Renal profile:
Urine protein, Blood urea & Creatitine.

Cardiac profile:
Cardiac enzymes (troption T), EKG & Chest x-ray

1.1.10. APPROACH TO MANAGEMENT OF HTN IN MODERN MEDICINE

Present day recommended in management of non-communicable diseases is not start the treatment with pharmacological agents because, these drugs has to be consumed life time to maintain the blood pressure level and they all have a number of side effects and these drugs can also react with dietary factors and habits such as drinking and smoking which in turn their therapeutic efficacy causing toxic effect[29].

1.1.11.PHARMACOTHERAPY IN MODERN MEDICINE3

There are many classes of medications for treating hypertension, together called antihypertensive, which, by varying means, act by lowering blood pressure.

Diuretics	**Vasodilators**	**Cardio inhibitory drugs**
• Thiazide diuretics • Loop diuretics • Potassium sparing diuretics	• Alpha adrenoreceptor antagonists (alpha, blockers) • Angiotensin converting enzyme inhibitors (ACE inhibitors) • Angiotensin receptor blockers (ARBs) • Calcium channel blockers (CCB) • Direct acting arterial dilators • Endothelin receptor antagonists • Ganglionic blockers • Nitrodilators • Potassium channel openers	• Beta blockers (BB) • Calcium channel blockers • Centrally acting sympatholytic

Table.4. Classification Antihypertensive Drugs

1.1.12.FOLLOW-UP AND MONITORING

Once antihypertensive drug therapy is initiated, most patients should return for follow-up and adjustment of medications at monthly intervals or less until the BP goals reached. More frequent visits will be necessary for patients with stage 2, hypertension or with complicating conditions.

Serum potassium and creatinine should be monitored at least 1 to 2 times/year.

After BP is at goal and stable, follow-up visits can usually be at 3 to 6 months intervals.

1.1.13. LIFE STYLE CHANGE

The lifestyle change is the mainstay in the management of HTN. Over the past few decades, numerous non-drug therapeutic modalities have been evaluated in regard to their potential blood pressure-lowering abilities[31]. *Yoga* is a non-pharmacological self-corrective technique on a lifestyle of joy and satisfaction. It brings about an attitudinal change at the psychological level. Looking at the risk factors for HTN, it is now that it requires a total change in one's attitude to refrain totally from smoking, change the food habits, and lead a stress free life. *Yoga* offers many techniques that correct the meaning and purpose of living, thus preventing stress that may result from suppression of forced life style change.

Yoga, not only provides the philosophy or logical back up in the form of right concept to answer why one should lead a life of moderation with control over one's instinctual behavioral patterns, but also provides highly evolved time tested techniques for healthy living. For example, *yama* and *niyama*, the first two components of *asṭhānga yoga* described by *patanjali,* the concepts of *karma yoga* from *bhagavat gita*, *bhakti yoga* from *nārada bhakti sutra* and *jñāna yoga* from *upanisads* addresses the basic concept about one's purpose and meaning of life style. Starting from many do's and dont's (*niyama* & *yama*) to culture the mind during interaction in the society *yoga* gives simple norms for right living; *yoga* helps one to climb up the pedestals to the climax of *jñāna* or *mokṣā* where the individual could live in perfect harmony and bliss unperturbed by the waves of the joys or depression of life.

The clue to right living is summarized in *bhagavat gitā* as; he who is moderate in food, activity, entertainment, sleep, and wakefulness attains *yoga* which destroys suffering.

युक्ताहारविहारस्य युक्तचेष्टस्य कर्मसु ।

युक्तस्वप्नावबोधस्य योगो भवति दुःखहा॥ भ गी ६-१७॥

yuktāhāravihārasya yuktaceṣṭasya karmasu ।

yuktasvapnāvabodhasya yogo bhavati duḥkhahā ।। Bha Gī 6-17।।

1.1.14.CAM THERAPIES IN HTN

There are many CAM (complementary and alternative systems of medicine) therapies that include both pharmacological and non-pharmacological therapies, some of them with highly evolved philosophical basis that differ from the philosophy of modern medicine. These CAM systems that are widely practiced in different geographical areas include *āyurveda,* Homeopathy, Traditional Chinese system of medicine, Unani, *Siddhā,* Naturopathy, *Yoga*, etc. There are many publications that have shown the efficacy of some of these some of these complimentary tools to manage non-communicable diseases in general and HTN in particular[30].

1.1.15.NEED FOR THE PRESENT STUDY

According to *āyurveda* and *yoga* health is a state of balance and disease is imbalance. Treatment of a disease involves restoration of balance by considering many factors that are involved in producing the imbalances in the body. The imbalances are said to be caused by lifestyle which results in production of endotoxins (*āma*), the result of improper digestion. Detail pathophysiology of how lifestyle goes on to production of toxins that enter the tissues, produce an imbalance and disease (HTN) is described in chapter 3. The therapy aims at clearing these toxins from the tissues by increasing the elimination of the three *malas* (excreta), the feces, urine and sweat. Hence, according to *yoga* and *āyurveda*, clearing the bowel through either physical techniques called *kriyās*/ *panchakarmas* or use of herbal preparations as medication, is mandatory in the management of all chronic diseases.

Our earlier pilot studies in which we had used an integrated approach of *yoga* we tried to incorporate bowel clearing *kriyās*. As these techniques are very strenuous it was not acceptable to the attending clinicians. Hence we had to look for simplified versions of the same. Hence *laghu śankha prakśālana* without using saline water was tried and found to be safe with add on benefits. *Āyurveda* recommends the use of *triphalā*, an herbal preparation as a mild laxative for clearing the bowel. There are no published studies on the safety and utility of LSP in patients with HTN. Hence the present study was planned to look at the feasibility, safety and also the add-on effects of LSP and LSP with *triphalā* water, in a residential set up for patients with HTN.

2. AIMS AND OBJECTIVES

2.1. AIMS

To study the safety and usefulness of adding *laghu śankhaprakśālana* to the integrated approach of *yoga* therapy in patients with essential hypertension.

2.2. OBJECTIVES

1. To find out the safety of *laghu śankhaprakśālana* practices in patients with essential hypertension.
2. To study the effect of *laghu śankhaprakśālana* on blood pressure in patients with essential hypertension.
3. To study the effect of *triphalā laghu śankhaprakśālana* on blood pressure in patients with essential hypertension.
4. To compare the effect of *triphalā laghu śankhaprakśālana* with *laghu śankhaprakśālana* on blood pressure in patients with essential hypertension.
5. To document the overall effect of the weeklong practice of IAYT with add on LSP and LSP with *triphalā* water.

2.3. RESEARCH QUESTIONS

A. Is LSP safe for patients with hypertension?

B. Does *laghu śankha prakśalana* (*yoga* based bowel cleansing technique) increase the blood pressure immediately after the practice in patients with essential hypertension?

C. Does adding of *triphalā,* an *āyurveda* herbal preparation, to the water used for *laghu śankha prakśalana* improve the bowel clearing effect?

D. Does clearing the bowel through LSP improve the results of IAYT?

2.4. HYPOTHESIS

A. LSP can be given safely to patients with mild to moderate hypertention.

B. LSP done with the right understanding does not increase the blood pressure

C. LSP with *triphalā* water will give better results than LSP with plain water.

D. Clearing the bowel through LSP gives a good feeling of comfort and compliments the effect of IAYT for patients with HTN.

2.5. NULL HYPOTHESIS

A. LSP will increase the blood pressure in patients with HTN

B. LSP is not a safe practice for patients with HTN

C. LSP with *triphalā* water has no additional benefits than LSP with plain water in patients with HTN.

CHAPTER 3

3. LITERARY RESEARCH

This chapter has deals with the knowledge related to hypertension as portrayed in ancient scriptures of *āyurveda* and *yoga.*

3.1. *ĀYURVED*[31]

Āyurveda is the most ancient medical science on the earth that originated in India approximately five thousand years ago.

The word *āyurveda* consists of two terms "*Āyu*", the life and "*veda*", the knowledge, so *āyurveda* is all about the science of life. It encompasses all the regiments to be followed from birth till death in order to have a healthy life. It also deals with treatment of different of diseases.

According to *Āyurveda* the purpose of the human life is to achieve the *puruśararthas* (the four human goals) Viz. *dharma* (righteousness), *artha* (resource of living), *kāma* (desires) and *mokṣā* (liberation).

धर्मार्थसुखसाधनम् आरोग्यं मूलत्तमम् । च सु १/२५

dharmārtha sukha sādhanam ārogyam mūlattamam। Ca Su 1/25

It is very important to have good health in order to achieve the four goals of life (*puruśarartha)*.

शरीरमाद्यं खलु धर्मसाधनम्॥ रघुवंशम् ॥

śarīramādyaṁ khalu dharmasādhanam।। Raghuvaṁśam ।।

Maintaining the perfect health of the body *(śarira)* is the primary requirement *(mādyam)* to achieve this final goal *(sādhana)* of living in a righteous life.

3.1.1. Definition of Health:

What is perfect health? It is not just the absence of diseases. WHO says 'it's not mere absence of disease, but it is a state of well being at physical, mental, social and spiritual level'.

Āyurveda offers a broad perspective for the definition of health. It has a unique definition which encompasses all dimensions of human existence and relates to balance at all levels of existence.

समदोषः समाग्निश्च समधातु मलक्रियाः।

प्रसन्नात्मेन्द्रियमनाः स्वस्थ इत्यभिधीयते॥ सु सू - १५. ४१॥

samadoṣaḥ samāgniśca samadhātu malakriyāḥ ।
prasannātmendriyamanāḥ svastha ityabhidhīyate ।।Su sū - 15. 41 ।।

Sāma doṣa - equilibrium/balanced state of *tridoṣa*, *sāma-nāgnih ca* - equilibrium in *pancha agni*, *sāma dhātu* - equilibrium condition in s*aptadhātus*, *malakriya*-normal state of evacuation of *mala*, *prasannātmendriya manaḥ* -blissful state of sense organs and mind is called *svastha* i.e. perfect health in which man is established in this inner being.

Let us look at each one of these aspects, *doṣa* (the humors), *dhātu* (tissues) and *mala* (waste products) in detail as portrayed in this science.

3.1.2. Doṣa:

According to *āyurveda* the body is composed of three main fundamental components derived from the five basic elements of the universe (earth, water, ether, fire and space). These are called *doṣas*.

3.1.2.1. Definition of doṣa:

दुष्यन्ति इति दोषः । च सू ५।२०

duṣyanti iti dośaḥ। Ca Sū 5।20

Doṣa is that vital energy which can get vitiated (disturbed) and can vitiate other components of the body, the *dhātu* and *mala.*

Generally the term *doṣa* is used to translated as humor in english language, but it has a subtler meaning. It refers to an inner bioenergy system that controls all functions of the body.

3.1.2.2. TWO TYPES OF DOṢA

वायुः पित्तं कफश्चोक्तः शारीरो दोषसङ्ग्रहः ।

मनसः पुनरुद्दिष्टो रुजश्च तम एव च॥ च सू १।५७ ॥

vāyuḥ pittaṁ kaphaścoktaḥ śārīro doṣasaṅgrahaḥ ।
manasaḥ punaruddiṣṭo rujaśca tama eva ca।। Ca Sū 1।57 ।।

Depending on their location the *doṣas* are divided into two main types viz. *shāririka doṣa* and *mānasika doṣa.*

There are three *shāririka doṣa* Viz. *vāta, pitta* and *kapha* and two *mānasika doṣas* are *raja* and *tamas*.

Doṣa	
1. Shāririka	***2. Mānasika***
Vāta	*Raja*
Pitta	*Tama*
Kapha	

Types of doṣa

3.1.2.3. Sharirika Doṣa [32]

वायुः पित्तं कफश्चोक्तः शारीरो दोषसङ्ग्रहः । च सू १।५७ ॥

vāyuḥ pitaṁ kapha ścotkaḥ śariro doṣa sangraḥ। Ca Sū 1।57

These *dośas* (humors) are three in number; *vāyu (vāta), pita,* and *kapha;* they are present in all parts of the body; hence they are called *śarira doṣas* (body humors).

These *doṣa* are responsible for all physiological functions of the body like movement, metabolism and when vitiated leads to pathology in the body.

सर्वशरीरचरास्तु वातपित्तश्लेष्मणः सर्वस्मिन् शरीरे ।

कुपिताकुपिताः शुभाशुभानि कुर्वन्ति। च सू २०।९ ॥

sarva śarīracarāstu vātapittaśleṣmaṇaḥ sarvasmin śarīre
kupitākupitāḥ śubhāśubhāni kurvanti। Ca Sū 20।9

Tridoṣas are present in the whole body and they are responsible for maintaining the health in their normal state; the same *doṣas* destroy the health when they become abnormal/vitiated.

3.1.2.4. FUNCTIONS OF EACH DOṢAS

1) vāta:

क्रियाणां कायक्रियाणां प्रसारणाकुञ्चनादीनां वाक् क्रियाणां भाषितादीनां बुद्धिकर्मणां पञ्चानाम् ।

बुद्धीन्द्रियाणां मनसो बुद्धेश्च स्वे स्वे विषये प्रवृत्तौ मोहस्याभवं करोति ॥ डल्हण सू श ७. ८॥

kriyāṇāṁ kāyakriyāṇāṁ prasāraṇākuñcanādīnāṁ vāk kriyāṇāṁ bhāṣitādīnāṁ buddhikarmaṇāṁ pañcānām
buddhīndriyāṇāṁ manaso buddheśca sve sve viṣaye pravṛttau mohasyābhavaṁ karoti।
ḍalhaṇa sū śa 7. 8 ।।

Vāta is responsible for all movements *(kriyāṇāṁ)* including the bodily functions *(kāyakriyāṇām)* such as constriction and expansion *(prasaraṇākuncanām),* act of linguistic articulation and speech *(vak kriyāṇāṁ bhāṣitām)*, intellect *(buddikarmaṇam),* digestion *(pancanām),* control of senses functions *(īndriyāṇām),* mind *(manasah)* and also responsible of conneting the sense organs with their objects and produce the feeling of desire *(mohah).*

Grossly, we can say that all movements in the body are carried out by *vāta doṣa.*

2) Pitta:

यत् पित्तम् उष्मा च यो या च भः शरीरे तत्सर्वम् आग्नेयं दर्शनं च। च शा ८।१६

yat pittaṁ uṣmā ca yo yā ca bhaḥ śarīre tatsarvam āgneyaṁ darśanaṁ ca। Ca Śā 8।16

Pitta is heat. It maintains the body temperature *(uṣmā)* and helps in all those functions that require energy utilization including a visual *(darśanaṁ)* activity. We may say that *pitta* is responsible for all metabolic functions and temperature regulation.

3) Kapha:

श्लेष्मा स्थिरत्वास्निग्धत्वसन्धि-बन्धक्षमादिभिः। अ हृ सू ११।३

śleṣmā sthiratvāsnigdhatvasandhi bandhakṣamādibhiḥ। A Hṛ Sū11।3

Śleṣmā (Kapha) confers stability *(sthiratvā)*, lubrication *(snigdha)*, compactness firmness of the joints *(sandhi bandha)*, forbearance *(kṣamadi)* (capacity to withstand or withhold emotions, strain etc.).

Maintaining the anatomical and physiological integrity of the tissues is the function of *kappa*.

प्राकृतस्तु बलं श्लेष्मा विकृतो मलमुच्यते ।

स चैवोजः स्मृतः कायेन च पाप्मोपदिश्यते॥ च सु १७।११७

prākṛtastu balaṁ śleṣmā vikṛto malamucyate।
sa caivojaḥ smṛtaḥ kāyena ca pāpmopadiśyate।Ca Sū 17।117

A healthy state of *kapha* gives strength *(bala)* to the body. When vitiated *(vikruta)* it becomes *mala* (the excretory product).

3.1.3. Dhātu:

त एते शरीरधारणद् धातव इत्युच्यन्ते। सु सू १५।२०

ta ete śarīradhāraṇad dhātava ityucyante। Su Sū 15।20

The material which supports and nourishes (*dharaṇa*) the body is called *dhātu*. It consists of all the structures of the body I. e. cells, tissues, organs etc.

3.1.3.1. Typesof dhātu (sapta dhātu):

रसरक्तमांसमेदोऽस्थि मज्जाशुक्राणिधातवः। अ स सू १।१३

rasaraktamāṁsamedo'sthi majjā śukrāṇidhātavaḥ । A Sa Sū 1।13

Rasa (Essence of food), *rakta* (blood), *mamsa* (muscle), *meda* (adipose tissue), *asthi* (skeletal), *majja* (bone marrow) and *śukra* (semen) are the seven *dhātus*.

3.1.3.2. Functions of *Dhātu*

प्राणिनां जीवनं लेपः स्नेहो धारण पुरणे।

गर्भोत्पादश्च धातूनां श्रेष्ठं कर्म क्रमात् स्मृतम् ॥ अ ह्र सू ११।४

prāṇināṁ jīvanaṁ lepaḥ sneho dhāraṇa puraṇe।

garbhotpādaśca dhātūnāṁ śreṣṭhaṁ karma kramāt smṛtam ।। A Hṛ Sū 11।4

Dhātu maintains the vital *(jivana)* functions of life, nourishes *(lepah)*, maintains the adhesive integrity (*snehah*), holds together *(dhāraṇa)* and helps in reproduction *(garbhotpāda)*.

Thus dhatu, *dhātu* refers to the functioning anatomy of all tissues.

3.1.4. Mala:

मलिनीकरणात्मलाः। शा पू ५।२४

malinīkaraṇātmalāḥ ।Śā Pū 5।24

That which has the capacity to pollute *(malinīkaraṇā)* is mala. The waste product ready for excretion is called *mala*. There are three *malas* in the body.

किट्टमन्नस्य विण् मूत्रं रसस्य तु कफोऽ सृजः ।

पित्तं मांसस्य खमल मलः स्वेदस्तु मेदसः॥

स्यात् किट्टं केशलोम स्थानो मज्जः स्नेहोऽक्षिविट् त्वचाम्॥ च चि १५।१८

kiṭṭamannasya viṇ mūtraṁ rasasya tu kapho' sṛjaḥ ।

pittaṁ māṁsasya khamala malaḥ svedastu medasaḥ।।

syāt kiṭṭaṁ keśalomā sthāno majjaḥ sneho'kṣiviṭ tvacām।। Ca Ci 15।18

Feces, urine and sweat are the three wastes of the body. Feces (*viṇ*) and urine *(mutraṁ)* are the end product of digested food *(kiṭṭamanna)* and sweat is the by product of metabolism of *meda* (fat metabolism).

Importance of malas:

Impaired elimination of the three *malas* can lead to diseases by respective *sroto dhusti* (disturbed channels).

3.1.5. Srotasa (Systems):

Dośas, dhātus and *malas* work in harmony with a highly organized complex system of integration of their functions by talking to each other through the bioenergy channels called *srotas*. *srotas* communicate through secretions (transmitters).

स्रवणात् स्रोतस। च वि ५।८

sravaṇāt srotasa। Ca Vi 5।8

That which secretes *(sravaṇa)* and allows to flow is called *srotasa.*

Thus, *srotas* refers to that which maintains the integrative functioning of different systems in the body such as respiratory system, circulatory system, endocrine system etc.

There are thirteen types of *srotas* mentioned in all texts. They are :

1) Prāṇavahā (Respiratory system):

तत्र प्राणवाहानां स्रोतसां हृदयं मूलं महास्रोतश्च। च वि ५।८

tatra prāṇavāhānāṁ srotasāṁ hṛdayaṁ mūlaṁ mahāstrotaśca। Ca Vi 5।8

This is one of the important system *(mahāstrotas)* and is located near the heart region *(hridaya mula).* The main function of this system is to supply *prāṇa*, the vital energy to different organs of the body.

2) Udakavaha (fluid circulatory System):

उदकवाहानां स्रोतसां तालुमूलं क्लोम च। च वि ५।८

udakavāhānāṁ srotasāṁ tālumūlaṁ kloma ca। Ca Vi 5।8

Udakavaha srotas, located the root of the tongue *(tālu)* and pleura *(kloma)* it helps in fluid circulation.

3) Annavahā (Digestive system):

अन्नवाहानां स्रोतसामामाशयो मूलं वामं च पार्श्वम्। च वि ५।८

annavahānaṁ srotasāmāmāśayo mūlaṁ vāmaṁ ca pārśvam । Ca Vi 5।8

Stomach *(āmāśaya)* is the root of the digestive system and is situated in the left *(vāma)* lateral *(pārśva)* aspect of the abdomen.

4) Rasavahā (Circulation of essesnce of food):

रसवाहानां स्रोतसां हृदयं मूलं दश च धमन्यः। च वि ५।८

rasavahānāṁ srotasāṁ hradayaṁ mūlaṁ daśa ca dhamanyaḥ। Ca Vi 5।8

Rasa refers to the essesnce of food that is formed after healthy digestion (?The chyle) and circulates through the heart *(hridaya)* by the help of arteries *(dhamani).*

5) Śoṇitavahā (Hemopoitic system):

शोणितवाहानां स्रोतसां यकृन्मूलं प्लीहा च। च वि ५।८

śoṇitavahānāṁ srotasāṁ yakranmūlaṁ plīhā ca। Ca Vi 5।8

Liver *(yakran)* and spleen *(plīhā)* are fundamental seat *(mūlaṁ)* of production of blood.

6) Māṁsavahā (Muscular system):

मांसवाहानां च स्रोतसां स्नायुर्मूलं त्वक् च। च वि ५।८

māṁsavahānāṁ ca srotasāṁ snāyurmūlaṁtvak ca। Ca Vi 5।8

Māṁsavaha system takes shelter in ligaments *(snāyu)* and skin *(tvak).*

7) Medovaha (Adipose system):

मेदोवाहानां स्रोतसां वृक्कौ मूलं वपावहनं च । च वि ५।८

medovahānāṁ srotasāṁ vṛkkau mūlaṁ vapā vahanaṁ ca। Ca Vi 5।8

Fat is seated around the kidney *(vṛkka)* and diaphragm *(vapā).*

8) Asthivahānā (skeletal system):

अस्थिवाहानां स्रोतसां मेदोमूलं मूलं जघनं च । च वि ५।८

asthivahānāṁ srotasāṁ medomūlaṁ mūlaṁ jaghanaṁ ca। Ca Vi 5।8

Skeletal system *(asthivahā)* is nourished fat *(meda).*

9) Majjavaha (Bone marrow system):

मज्ज वाहानां स्रोतसाम् अस्थीनिमूलं सन्धयश्च। च वि ५।८

majjavahānāṁ srotasāṁ asthīni mūlaṁ sandhayaśca । Ca Vi 5।8

Bone marrow *(majja)* situated in bones *(asthī)* and joints *(andhi).*

10)Śukravahā (Reproductive [semen] system)

शुक्रवाहानां स्रोतसां वृषणा मूलं शोफश्च। च वि ५।८

śukravahānāṁ srotasāṁ vṛṣaṇāu mūlaṁ śophaśca। Ca Vi 5।8

Synthesis of semen *(śukra)* take place in the testis *(vṛṣaṇā)* and its seats is the scrotum *(śopha)*.

11)Mūtravahā (Urinary system):

मूत्रवाहानां स्रोतसां बस्तिर्मूलंवङ्क्षौ च। च वि ५।८

mūtravahānāṁ srotasāṁ bastirmūlaṁ vaṅkṣṇau ca। Ca Vi 5।8

The seat of the urinary system is the bladder *(basti)* and the lower part of the loin *(vakṣṇa)*.

12)Purīṣavahā (Fece excretory system):

पुरीषवाहानां स्रोतसां पक्वाशयो मूलंस्थूलगुदं च। च वि ५।८

purīṣavahānāṁ srotasāṁ pakvāśayo mūlaṁ sthūlagudaṁ ca। Ca Vi 5।8

Rectum *(sthūlaguda)* and pelvic region *(pakvāśa)* are the seat for the *srotas* for this system that handles the solid waste *(purīṣa)*.

13)Svedavahā (sweating system):

स्वेदवाहानां स्रोतसां मेदो मूलं लोमकूपाश्च। च वि ५।८

svedavahānāṁ srotasāṁ medo mūlaṁ lomakūpāśca । Ca Vi 5।8

The *srotas* that carries sweat has its seat in the sweat glands situated in *meda* (fat) and the roots of hair follicles *(lomakūpa)*.

3.1.6. CONCEPT OF AGNI

The term *agni* is generally used for digestive fire but in its broader aspect *agni* is the metabolic heat. *Agni* is also called *prāṇa* (life) and it is classified into *dehāgni, jātharāgni, kāyāgni* and *pācakāgni.* It is stated that the endotoxins *(āma)* are generated by abnormalities in the functioning of *agni.* The root cause of all diseases is the accumulation of toxins due to weak *agni*. The function of *agni* is to digest the *āma* (the toxins generated in the process of metabolic activities in the body) and eliminate them from the body and help in maintaining the health.

Kāyāgni refers to the fire/heat present in the body. Its site is *kosṭha* (alimentary tract); it is also called *kosṭhagni*; *jāṭhara* (stomach) being the seat for this *kosṭhagni* it is also known as *jāṭharagni*. As it attends to the important function of *āhāra pāka*, digestion of food, it is also called *pācakāgni*. It cooks the food and prepares the nutrients required for all *dhātus,* the tissues; each one of the *dhātu*

has within it an *agni*, fire like vital energy, which is a component of the portion of the *jāṭharagni*, because of their identical functions. This *agni* presents in the *dhātu (dhātvāgni)* cooks the nutrient material prepared by the *jāṭharagni* and transforms it so as to become suitable to the *dhātu*. In this function, the *dhātvāgni* receives it strength from the *jāṭharagni* and both work in union; if the *jaṭharagni* is very strong, the *dhātvāgni* also becomes very strong, overcooks (increases BMR) the nutrients, thereby making very little nourishment available for other functions, which in turn leads to *dhātukṣaya* (decrease or loss of the tissues, tissue wasting, cachexia). Very weak *agni*, on the other hand, fails to cook the food materials properly and allows *āma* to accumulate in the *dhātus* leading to *dhātuvṛddhi* (abnormal increase of the tissues); both *vṛddhi* and *kṣaya* (of the *dhātu*) are abnormal which give rise to systemic diseases as described in this sloka.

स्वस्थस्य कायाग्नेरंशा धातुषु संश्रिताः।

तेषांसादातिदीप्तिभ्यां धातुवृद्धिक्षयोद्भवः ॥

पूर्वो धातुः परं कुर्याद्वृद्धः क्षीणश्च तद्विधम्। अ ह्र सू ११।३५

svasthasya kāyāgneraṁśā dhātuṣu saṁśritāḥ।

teṣāṁ sādātidīptibhyāṁ dhātuvṛddhi kṣayodbhavaḥ ।।

pūrvo dhātuḥ paraṁ kuryādvṛddhaḥ kṣīṇaśca tadvidham। A Hṛ Sū 11।35

Kāyāgni (metabolic fire) although present in its own place, has its portion in the tissues *(dhātu saṁśrita)* also. Decrease (in quantity or quality of functions) or an increase of the corresponding *agni* gives rise to increase and decrease of the functioning of the *dhātus* respectively. The increased or decreased functioning of a preceding *dhātu* leads to similar changes in the succeeding *dhātu*.

3.1.7. CONCEPT OF ĀMA:

Definition of āma:

Āma refers to anything that exists in a state of incomplete transformation. In particular, refers to the toxic by-product generated due to improper digestion.

Different definition of *āma* according *āyurveda.*

ऊष्मणोऽल्पबलत्वेन धातु माद्यामपाचितम् ।

दुष्टमामाशयगतं रसमाममं प्रचक्षते॥

अन्ये दोषेभ्यः एवाति दुष्टेभ्योऽन्योन्यमूर्छनात्।

को द्रवेभ्यो विषस्येव वदन्त्यामस्य सम्भवम्॥ अ हृ सू १३।२४

ūṣmaṇo'alpa balatvena dhātu mādyāmapācitam।

duṣṭamāmāśaya gataṁ rasamāmaṁ pracakṣate।।

anye doṣebhyaḥ evāti duṣṭebhyo'nyonyamūrchanāt।

kodravebhyo viṣasyeva vadantyāmasya sambhavam।। A Hṛ Sū 13।24

The hypo-function of *ūṣmā* (*agni*), results in incompletely digested food, yields immature *rasa* in *āmāśaya* (alimentary tract) which in turn undergoes fermentation. The resulting substance is called *āma*. This description of *āma* refers to that is produced in *āmāśaya;*

The word *āma* also has a generalized meaning which can be applied to the endotoxins that are generated by the deficiency of any of the working *agni* in the body.

***Mādhava nidana* defines *āma* as:**

आमाशयस्थः कायाग्ने दौर्बल्यादविपाचितः।

आद्यम् आहारधातुर्यः स आम इति किर्तितः॥ मा नि २५।१

āmāśayasthaḥ kāyāgne daurbalyādavipācitaḥ।

ādyam āhāradhāturyaḥ sa āma iti kirtitaḥ। Mā Ni 25।1

Due to the feebleness of *kāyagni*, the *āhāra rasa* is not properly formed in the *āmāśaya* and in this state it is known as *āma*. It is also told that the first *dhātu* i.e. *rasa dhātu,* if not formed properly due to deficient *agni* in the intestine it results in abnormal, *rasa dhātu* is termed as *āma*.

आहरस्य रसः शोषो यो न पक्वोऽग्निलाघवात्।

स मूलं सर्वरोगाणाम् आम इत्यभिधीयते॥ मा नि २५।१३

āharasya rasaḥ śoṣo yo na pakvo'gnilāghavāt।

sa mūlaṁ sarva rogāṇāṁ āma ityabhidhīyate।। Mā Ni । 25।13

The final product of the *āhāra rasa* which does not get properly transformed due to feeble digestive fire is called *āma* and is considered as the root cause of all diseases.

Hence *āma* can be considered as an undigested or partially or wrongly digested/metabolized substance which requires further processing *(pariṇāma)*. When this is retained without further processing, it may produce *srotovaiguṇya*, impairement in the micro and macro circulation in channels of the body. This ultimately leads to the accumulation of the provoked *doṣas* that get

converted to a disease. *Āma,* in all acute, sub-acute or chronic conditions relates to the gastrointestinal as well as metabolic disturbances resulting from impairment of *antarāgni*.

Thus, *āyurveda* has given much importance to the concept of *āma* than *āmaya* (disease). I.e. it is focussed on eliminating the causative endotoxic material, the *āma*. To treat the *āmaya* (disease), clearing the accumulated *āma* is the remedy.

Properties of āma (āma guṇa's):

अविपक्वमसम्युक्तं दुर्गन्धं बहुपिच्छिलं।

सदनं सर्वगात्रणाम् आम इत्यभिधियते॥ (अरुणदत्त अ ह्र सू १३)

Avipakva masamyuktaṁ durgandhaṁ bahuapicchilaṁ।

sadanaṁ sarvagātraṇāṁ āma ityabhidhiyate। (Aruṇadatta A Hṛ Sū 13)

Avipakkvam (incompletely transformed) –The production *āma* occurs due to malfunction of *agni;* the undigested or improperly digested substance that lies in incomplete metabolic state; is termed *āma*. This is described by the word *avipakkvam*.

Asamyuktaṁ (non-homogeneous)–Though *āma* has properties like *picchila* (slimy) and *snigdhata* (unctuous) due to which it sticks quickly to the other body tissues, *asamyuktaṁ* property refers to the stage of *āma* when it is just formed and is non-assimilable to tissues due to incomplete metabolism. At this stage *āma* lies in its free state, and after some time if not digested or excreted from the body, adheres to the tissue. Thus, the intermediate state, when it lies freely in the tissue is indicated by *asamyuktaṁ*.

Durgandhaṁ (Foul smelling) – Every *dravya* in the body has its specific odor. Though *āma* is also made up of same *dravya's,* as its compostion is altered due to incomplete metabolism. It develops a different odor this is usually foul smelling in nature. Also due to fermentation and putrefaction occurring during the formation of *āma* it has a bad odor. This property of *āma* is described by *durgandhaṁ*.

Picchilam (slimy) According to *hemadri,* definition of *picchila guṇa* is *yasya lepane śaktiḥ sa piccilaḥ* i.e. that substance which is capable of coating is called is called as *picchil*a. Due to this property *āma* sticks to healthy body tissue. Due to this property it adheres to the *srotas*, that nourish different *dośas* and *dhātus (dusya)* and *malas* (*vagbhaṭa*).

Sadanaṁ sarvagātrāṇāṁ : *Āma* is fluid (*drava guṇa)* (*caraka*) and due to this property *āma* spreads in every part of the body.

Symptoms of āma (āma lakṣaṇās):

स्रोतोरोधबलभ्रंशगौर वानिलमूटता :।

आल स्यापत्तिनिष्ठिवमलसङ्गारुचिक्लमाः ॥ अ ह्र सू १२।२३

srotorodhabalabhraṁśagaura vānilamūṭatā।

āla syāpattiniṣṭhivamalasaṅgāruciklamāḥ। A hṛ Sū 12।23

Srotorodha (obstruction in the channels of circulation): Normal functioning of *srotas* is very important in maintaining health. Due to the properties like *picchilam, snigdhata* etc. *āma* adheres to the walls of *srotas* and as a result the lumen of *srotas* becomes narrowed. Once this narrowing of lumen occurs, the normal functioning of *srotas* gets disturbed and this leads to disease. This mechanism is common to both micro and macro channels,

Balabhraṁśa (loss of strength): It is due to the systemic effect of *āma* that circulates in the body. *Balabhraṁśa* also occurs because of lack of proper nutrition; This results in reduction in the working power of *dośa, dhātu* and *mala's* throughout the body in which is referred to as *balabhraṁśa*.

Gaurava (Heaviness): *āma* causes heaviness in the whole body and/or different parts of the body. When *āma* accumulates at different sites this heaviness is felt.

Anilamūṭatāḥ (restricted movement of *vāyu*): *āma* causes *srotorodha* in *srotas* and hence there is an obstruction to the normal flow through the lumen. Due to *srotorodha*, free flow of *vāyu* becomes obstructed and that condition is termed as *anilamūṭatāḥ*.

Ālasyā **(**Stupor): This due to psychological effect produced by the presence of *āma* along with its effect of heaviness (*guruta)* etc. Patient suffering from accumulation of *āma* gets disturbed psychologically and becomes unable to perform this normal body activity, which is known as *ālasyā.*

Apatti (Incomplete digestion): The production of *āma* sets off a vicious circle. *Āma* is produced by *agnimāndya* (poor digestive fire). This in turn causes further *agnimāndya* which results in *appeti*. It appears that *appeti* refers to metabolic impairment taking place at micro level.

Nisṭhiva (Spitting/expectoration): When food is not digested properly a reflex is set which increases salivary secretions and results in frequent spitting.

Malasanga (obstruction to the movement of waste products): This is again due to s*rotorodha* at *mahasrotas* level. Also due to properties of *picchilam, snigdhata* and *guruta*, the *mala* (waste product) produced by incomplete digestion by the poor *jāṭharāgni*, sticks to the walls of the intestines and is difficult to expel out. At micro levels also the same processes occur. Due to *srotorodha* and sticking nature of *sāma mala*, *malasanga* takes place.

Aruci (loss of appetite): This refers to the effect of *sāma* (vitiated *dośa/dhātu/mala* due to accumulation of *āma*) over psyche. Patient experiences loss of appetite.

klamāḥ (Debility): In this state patient feels exhausted. Again, this is due to damage caused in the entire body by the circulating *āma*.

There are the main symptoms produced by *āma* in the body at various levels. The association of these symptoms along with signs and symptoms of disease help in diagnosing a disease as *sāma* or *niāma* . The treatment of a disease is based on this diagnosis.

3.1.8. CONCEPT OF DISEASE[33]

There are two kinds of diseases, physical and mental, as there are two principal locations or sites for the disease to manifest, the body or the mind. The assessment of normality and abnormality of the components of the physical body *(doṣa, dhātu, mala, agni etc)* gets the preference in diagnosis and management of a disease in *āyurveda* and that of the mind is important in *yoga* therapy.

Ācarya caraka says:

काल बुद्धीन्द्रियार्थानां योगो मिथ्या न चाति च।

द्वयाश्रयाणां व्याधीनां त्रिविधो हेतुसङ्ग्रहः॥ च सू 1/55

Kāla buddhīndriyārthānāṁ yogomithyā na cāti ca।

dvayāśrāyāṇāṁ vyādhīnāṁ trividho hetusaṅgrahaḥ।। Ca Sū 1/55

Both body and mind are the locations of diseases or disorders as well as pleasures. The balanced use of application of time, intelligence and sense objects is the cause of pleasure which basically provides, maintains and bestows good health and pleasureful life. Diseases occurs by perverted, negative and excessive utilization of time, intelligence and sence objects. Thus, it appears that these abnormalities in lifestyle contribute to both psychic and somatic disorders.

Mental illnesses are thought to originate from aggravation of the mental *doṣas* i.e. *rajas* and *tāmas guṇas*; while the physical diseases originate from the aggravation of bodily *doṣa* of *vāta*, *Pitta* and *Kapha*. Thus, the root cause of any disease in the human body, whether it is a physical disease or mental illness, can be treated by identifying the underlying imbalance in the *guṇa, doṣa* or the *mahābhūtas*, the five subtle elements. Increased and/or decreased functioning of any of the five elements. Results in illness and balancing their functions is the aim of therapy. The eternal truth of the *vedic* science allows every human being to experience *ānanda* (pure joy) by maintaining the highest level of physical, mental and spiritual health. *Ānanda* is experienced by maintenance of balance of *doṣas* and by careful controls of the proportion of the five elements that are taken in through all the senses organs.

3.1.9. HYPERTENSION IN ĀYURVEDA

It appears that the clinical entity of hypertension is not described as such in any of the classical literatures of *āyurveda.* We find more than a thousand diseases described in *āyurveda* which can be correlated with one or the other modern diseases such as *jvara* (Fever)*, rājayakṣma* (Tuberculosis), *visarpa* (Herpes)*, śvitra* (Leucoderma) etc. On the contrary it is difficult to find a clear-cut correlation to that of hypertension in *āyurveda*. There are detailed descriptions of the symptomatology of many cardiovascular diseases under *hṛidroga* (heart disease) and *pakṣāghāta* (stroke). We also find detailed descriptions of the properties of cardiovascular drugs such as *sarpagandha, arjuna* etc. We know that *āyurveda* has its unique method of detecting a disease as an imbalance of the *doṣa* even before the disease manifests. Thus we may say that hypertension was recognizable and treatable by looking for the manifestations of the three *doṣa* imbalances and prevent *hṛidroga* (heart disease) and *pakṣāghāta* (stroke) although there was no use of sphygmomanometers to measure the blood pressure and classify hypertension.

3.1.10. HRiDROGA

Hṛid is heart and *roga* is the disease. Although the meaning of the word '*hṛidroga*'is 'heart disease', it encompasses all the conditions and hence we may say that essential hypertension is also the condition related to *hṛidroga*.

3.1.10.1. CAUSES OF HRIDROGA ACCORDING TO ĀYURVEDA

व्यायामतीक्ष्णातिविरेकबस्तिचिन्तभयत्रासगदातिचाराः।

छर्द्यामसन्धारणकर्शनानि हृद्रोगकर्तृणि तथाऽभिघातः॥ च. चि २६/७७

vyāyāmatīkṣṇātivirekabasticintabhayatrāsagadāticārāḥ ।

chardyāmasandhāraṇakarśanāni hṛdrogakartṝṇi tathā'bhighātaḥ ।। Ca. Ci 26/ 77

The causes of *hṛidroga* are excessive *vyayāma* (exercise), *tikshana sevana*, *virecana* (purgation), *basti* (Enema), *chinta (*worries), *bhaya* (fear), *trasa* (torture), *gadāticārā* (Excessive mace fighting), *charda* (vomiting), *āma dośa* (toxins), *vega dhāraṇa* (withhold of urges), *karShaṇāni* (Lean person) & *abhighata* (trauma).

Observation and analysis of the scriptural references for the *nidāna* (cause), *samprāpti* (pathophysiology) and *lakṣaṇa* (manifestations) of *bhrāma* or *hṛidroga* (which could be related hypertension) reveals detailed descriptions of the life style changes that are of three categories:

MityāharaVihāra:

Improper diet *(ahṛidya āhara)*: Consumption of excessively pungent, heavy, dry, incompatible, unaccustomed, un-digestible foods which are basically *dhātuproduśaka* (which vitiate the *dhātus*), *viruddha* (incompatible or contraindicated), and *apatarpaka* (under nutrients or which is not nourishes) contribute to *hṛidroga*.

Improper activity regimen (*Mithy Vihāra):*

Strong emotional stress (c*intānām ati cintanam*), intermittent eating, faulty therapeutic measures like *basti vyapathya* (complications of enema) *virecanavyapath* (complications of purgation) that are *rasa dhātu pradūśaka* (vitiate the *rasa dhātus*), and also *rasavaha srothodusṭi kāraka* (vitiate the channels, the *srotasa*, that carry the *rasa,* the digestive essence).

These etiological factors *(nidānas)* cause *apatarpaṇa* (under nutrients) of *rasadhātu* which leads to *hṛidayāvaya dusṭi* (vitiation of heart). When nourished by *duśitarasadhātu* (vitiated *rasadhātu*). Even the *santarpaṇa nidānas* (deistic cause) mentioned like *tila* (sesame), *guda* (jaggery) *guru āhara* (heavy food) cannot provide proper nourishment. But they result in *āma sandharaṇa* (accumulation of toxin) which accumulates in *rasavahasrotas* (circulation of essence of food) that has to maintain the health of the *hṛidya* (heart). It forms an *upalepa* (coating) leading to

granthi (occlusion) formation, which in turn hampers *vyāna vāta sancāra (*circulation of *vyāna vāta*), creating *vaiśamya* (vitiation) in its *gati* (movement). Looking at this description in the light of our present day understanding, it appears that the *duśitarasadhātu* could be the bad cholesterol (*āma*) that coats the interior of the arteries (*rasavaha srotasa*) that blocks the free flow of *vāta*, the vital energy, that was meant to allows free flow of blood in the arteries.

Prajñāparadha:

The other life style factor refers to instigation and inhibition of natural urges especially that of *adhovāta* (flatus), *trishna (*thirst*), aśru (*tear*), cardi (*sneez*), śrāma (*tiredness*), śvāsa (*breathing*), ūdgāra (*belching*)*. Excessive physical exertion, grief, fasting, sexual abuse, awakening at night, excessive sleep etc., which are volitional transgression of body and mind biorhythm contribute to the etiology of heart diseases. *Prajñāparadha* also includes violation of the injunctions healthy *dinacārya* (daily regimen), *rutucarya* (seasonal regimen), *and svasthavruta* (preventive care).

All description show that they are basically related with the functioning of *praṇavāta* (*vāta* which seated in throat), *apānavāta* (*vāta* seated in lower part of abdomen), *udānavāta* (*vāta* seated in chest region), which vitiates also the *vyānavāta* (*vāta* which circulates throughout body), simultaneously, *Vyānavāta always* functions in harmony with the other components of the *vāta*, the *hridayāvayava dusṭi* (disharmony in cardiac function), and manifests as *hridroga.*

Marmāghāta:

Hṛidaya is an important *marmānga* (vital organ). Any injury to this organ externally or by the internal *doṣa* imbalance due to wrong life style proves to be fatal. Hence, it should be protected with care.

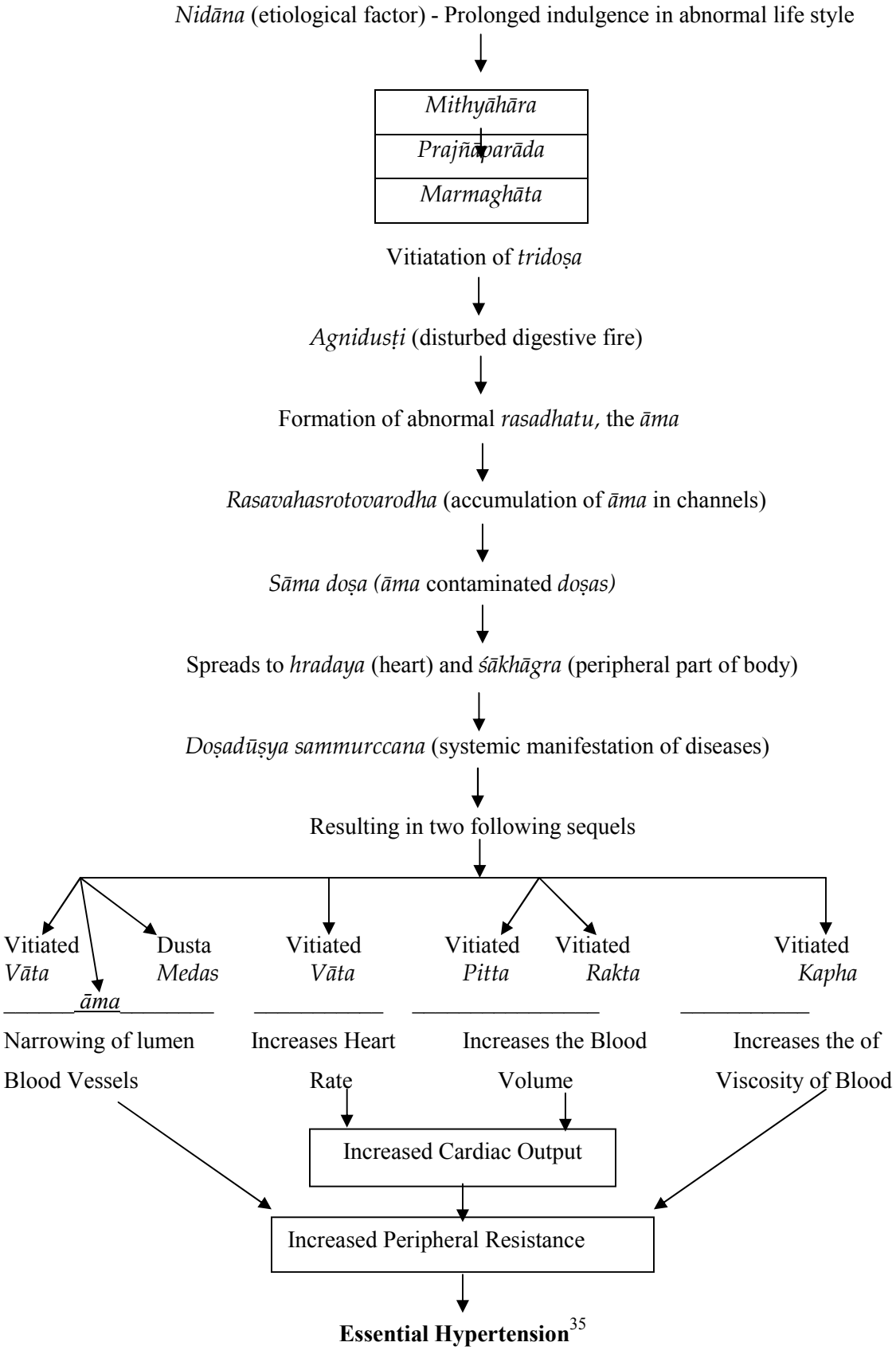
If we look at these causes carefully, it appears that long term exposure to these factors such as fear, excessive physical exercise, and worry, anger etc. will lead to increased sympathetic tone which is associated to essential hypertension[34].

3.1.10.2. PATHOPHYSIOLOGY OF HYPERTENTION ACCORDING TO ĀYURVEDA

The pathogenesis of essential hypertension is hypothetical pathogenesis have been mentioned in many of the modern texts. But when we look in terms of *āyurveda*, it seems to be a *tridoṣaja vyādhi*

(imbalance in all *doṣa*s) with *vāta pradhāna (*dominancy of *vata)*, *pitta kaphānubandha (*association of *pitta)* and *pradhāna dūṣya (*involvement of *kapha* as vitiated *doṣa)* involved to be as *rakta* (in the blood).

Here it is said that hypertension is *vāta pradhāna vyādhi* (*vāta* dominant disease), this increased *vāta* can be correlated with sympathetic over-drive.


Nidāna (etiological factor) - Prolonged indulgence in abnormal life style
Mithyāhāra
Prajñāparāda
Marmaghāta
Vitiatation of *tridoṣa*
Agnidusṭi (disturbed digestive fire)
Formation of abnormal *rasadhatu*, the *āma*
Rasavahasrotovarodha (accumulation of *āma* in channels)
Sāma doṣa (āma contaminated *doṣas)*
Spreads to *hradaya* (heart) and *śākhāgra* (peripheral part of body)
Doṣadūṣya sammurccana (systemic manifestation of diseases)
Resulting in two following sequels
Vitiated *Vāta*
Dusta *Medas*
āma
Vitiated *Vāta*
Vitiated *Pitta*
Vitiated *Rakta*
Vitiated *Kapha*
Narrowing of lumen Blood Vessels
Increases Heart Rate
Increases the Blood Volume
Increases the of Viscosity of Blood
Increased Cardiac Output
Increased Peripheral Resistance
Essential Hypertension[35]

Long term exposure to above mentioned causes leads to imbalance in the *doṣas* (increases *vāta doṣa* along with *pitta* and *kapha*) this can be correlated with increased sympathetic tone and increased the inflammatory markers like C-RP (C-reactive protein), IL-1 etc. This causes increased pulse rate, blood pressure, narrowing of arteries and increased viscosity of blood[36]. These are the manifestation of increased *pitta.* This in turn will leads to structural changes in the cardiomegaly, endothelial dysfunction which is nothing but *kapha doṣas*[37].

Finally vitiated overactive *vāta doṣa* produces increased hardening arteries due to its dryness property; make them narrow due to destruction of inner structure of the vessel.

3.1.10.3. ĀYURVEDIC MANAGEMENT OF HRIDROGA

Cikitsā aims not only at the radical removal of the causative factors of the disease, but also at the restoration of *doṣa* equilibrium. The prime importance of *cikitsā* is to break the *samprāpti ghaṭaka* and the integral factor-

तस्मात्विकारप्रकृति अधिष्ठानान्तराणि च
बुद्ध्वा हेतु विशेषश्च शीघ्रं कुर्यात् उपक्रमम्।
प्रत्येकंस्थान दुष्यादि क्रियावैशेष्यमाचर॥ अ ह्र सू १२/६६

tasmātvikāra prakṛti adhiṣṭhānāntarāṇi ca
buddhvāhetu viśeṣaśca śīghraṁkuryāt upakrāma m।
pratyekaṁsthāna duṣyādi kriyāvaiśeṣyamācara ।। A Hṛ Sū 12/66

The *cikitsā* should be started immediately after understanding the *prakriti, adhisthana* of *doṣa*. With this guideline, and views of *samprāptivighaṭaṇa* the ideal principles of *cikitsā* can be grouped into two categories;

- *Adravya bhuta cikitsā* or non-pharmacological management
- *Dravyabhuta cikitsā* or pharmacological management

Adravya bhuta cikitsā: include

- *Satvāvajaya cikitsā:* counseling
- *Yoga* and other relaxation techniques

Dravyabhuta chikitsa (pharmacological intervention): includes use of different formulations.

Formulations

Prabhākaravaṭi, Rasasindhura, Sarpangandhavati, Sārasvatāriṣṭa, Gokṣuradi, Guggulu, Kāmadugharasa, Pravālapiṣṭi, Yogendrarasa, Hradayeśvararasa, Candrakalā rasa.

Patent Medicines

Tab-Arjin, Tab-Seliden, Tab-Abana, Tab-*Sumanas*, and Tab-Supersarpa, Tab-Cardostab, Tab-Caditone, Tab-Bipasil, Tab-Hypnox, Tab-Somatone, Tab-Slogo etc., and though *Raktacāpādhikyatā* (literary meaning is blood pressure) is said to be *yāpyavyādhi* (treatable). In recent onset disease, *samprāptivighaṭaṇacikitsā* (treatment fixed on chronicity of disease) can be done by combining *doṣa pratyānika* (based on *doṣic* treatment) and *vyādhipratyānika cikitsā* (based on disease).

3.2. YOGA

3.2.1. DEFINITION OF YOGA

The *patanjali* defines in his second *patanjali'*s aphorism as '*yoga* is process of gaining mastery over the modifications of the mind[38]'.

योगः चित्त वृत्तिनिरोधः॥ प यो सू १।२

yogaḥ citta vṛttinirodhaḥ ।।Pa Yo Sū1/2

Then goes on to describe the reust of such mastery in the next sutra: 'The seer estblishes himself in his causal true state'.

तदा द्रष्टुः स्वरूपेऽवस्थानम् ॥ प यो सू १।३

tadā draṣṭuḥ svarūpe'vasthānam।। Pa Yo Sū1/3

In *patanjali yogasutra* the essence of *yoga* is beautifully portrayed as: *'Yoga* is a skillful trick to calm down the mind'. It is an *upāya*, a skillful subtle process and not a brutal, mechanical gross effort to stop thought in the mind.

मनः प्रशमनोपायः योग इत्याभिधियते। योगवासिष्ठः

manaḥ praśamanopāyaḥ yoga ityābhidhiyate।Yogavāsiṣṭhaḥ

In *yoga vasistha* defines *yoga* as balance or equinity.

समत्वं योग उच्यते । भ गी २।५८

samatvaṁ yoga ucyate। Bha. Gī .2/48

Krishna goes on to say that *yoga* is a capacity to function in a relaxed state: '*yoga* is dexterity in action'. dexterity refers to maintaining relaxation and awarness durign work. Relaxed action is the process. Efficiency in action is an out come. Action in relaxation is the skill[49].

योगः कर्मसु कौशलम् । भ गी २।५०

yogaḥ karmasu kauśalam | Bha. Gī .2/50

Gita defines *yoga* as the state in which all our sense organs *(indriyās)* are beheld steadily; i.e.this is a state of mastery over all senses including the mind.

तां योगमिति मन्यन्ते स्थिराम् इन्द्रिय धारणाम् । कठोपनिषत् २।५४

tāṁ yogamiti manyante sthirām indriya dharaṇām | kaṭhopaniṣat 2|54

Thus, the subtler state of mind featured by 'stadiness' is reffered to as *yoga*. *Yoga* is a state of great steadiness at emotional level; balance of concentration and detachment at mental level and homeostasis at body level. It integrates the personality by bringing body-mind coordination in a well balanced way.

3.2.2. TECHNIQUES OF YOGA

Integrated techniques to obtain mastery over mind include several practices that bring about deep relaxation to body mind complex. These techniques help in reaching the mind through awareness during the practice of life style injunctions (*yama* and *niyam*), cleansing practices *(kriyās)*, physical postures *(āsanas),* breathing techniques *(prāṇāyama),* meditation *(dhārana, dhyāna* and *ṣamadhi),* emotion culture techniques *(bhakti yoga),* self-analysis *(jñāna yoga)* and action in relaxation *(karma yoga)*. Some meditation and relaxation techniques that have been tried in cases of HTN include Mindfulness meditation,[39] Transcendental meditation,[40] cyclic meditation,[41] *prāṇāyama,*[102] *śavasana,*[42] and integrated *yoga*[43].

3.2.3. HYPERTENSION AND MENTAL STRESS[44]

STRESS

Stress is a response involves a cascade of biological changes that prepares the organism for the fight or flight reaction[90] or a genetically determined pattern of reaction to a demanding situation of the human physiology. The stress response begins in the hypothalamus, which stimulates the sympathetic nervous system (SNS). This, in turn, causes the internal portion of the adrenal glands

to secrete adrenaline & noradrenalin. As these circulate through the blood, they cause an increase in heart rate,

Stress situation could be of 2 types;

1. Physical stress like accidents, burns, major surgeries, infection, pregnancy etc., which make demands on the entire physiology

2. Psychological stresses which can occur independently or as a response to the physical stress. E.g.-are life situations that elicit emotional response like fear, anxiety, stress, worry, jealousy, hatred, anger, excitement, conflicts, etc. it may be temporary stress, demanding only an immediate adaptation process. Or it may be a long standing one, leaving a deep seated subconscious impression leading to prolonged stress.

STRESS & HYPERTENSION (HTN)

The stress response begins in the hypothalamus situated near the center of the head covered by the large fold of cerebral cortex, which stimulates the sympathetic nervous system (SNS). This, in turn, causes the internal portion of the adrenal glands to secrete adrenaline & noradrenaline. As these circulate through the blood, they cause an increase in heart rate. They also cause the body to metabolize glucose rapidly.

In addition to stimulating the SNS, the hypothalamus releases a hormone called "corticotrophin-releasing factor" (CRH). Traveling in the blood, this hormone stimulates the pituitary gland to secret adrenocorticotrophic hormone (ACTH), which stimulates the adrenal cortex to produce the stress hormone called "glucocoticoids". In humans, the stress glucocorticoid that is produced is called i.e. cortisol.

Due to stress, the blood vessels of the visceral organs constrict, and blood flows in greater quantity outward to the muscles of the torso and limbs. When tiny blood vessels supplying the visceral organs become constricted, the heart must work harder. As it beat faster and with greater force, the pulse quickens and blood pressure rises. When this occurs repeatedly over a number of years it becomes a habit of the heart & the blood vessels to remain in an excited state and they lose the capacity to return to resting levels. Repeated upsurges of blood pressure, in the long run, can remain as a cause of high blood pressure with all its complication. The blood pressure may remain persistently high. Normally blood pressure varies considerably within 24 hours of the day. Not surprisingly, it is at its lowest in the middle of the night and at its peak at the end of the workday.

Some of these changes are due to normal rhythms in the body's chemistry and some are related to stress & exercise.

3.2.4. ROLE OF MIND IN THE MANAGEMENT OF HYPERTENSION

There is evidence to suggest that mindfulness meditation can lower blood pressure; mindfulness-based stress reduction (MBSR) programs are founded upon an active awareness of physical and mental states & it's also improving psychological and physiological health outcomes in healthy individuals, A meta-analysis of MBSR in patients with chronic medical diseases showed positive effects on depression, anxiety, and psychological distress in people with chronic somatic diseases[44]. To boot, a meta-analysis of healthy adults who participated in MBSR showed reduced self-reported stress levels in healthy young and middle-aged adult. Furthermore, research has shown that meditation practice counters the effect of physiological stress responses by decreasing respiratory rate, total peripheral vascular resistance (blood pressure), and cortisol, the prototypical biological indicator of stress and aging.

3.2.5. IAYT AND HYPERTENSION[45]

The dictionary meaning of 'therapy', Greek word meaning healing, is treatment intended to relieve or heal the physical disorder or illness. As illness refers bodies & mind, therapy treat both. Conventional medicine, i.e. The allopathic treatment successfully treats a variety of illnesses with new medicines e.g. antibiotics using marvelous diagnostic tools offered by medical engineering and applied science. However, its success in treating psychosomatic diseases is determined as its treat body and mind separately, attributing diseases to diseases to dysfunction of organs & systems, resulting from congenital defects, atmospheric agents like allergens, toxins, pollutants or infectious microbes. Luckily, modern science also has begun to realize that internal imbalances from restlessness, emotional upsurges or intellectual conflicts etc. are also cause of disease. *Swami Vivekananda Yoga Anusandhana Samsthana* (SVYASA) has utilized *yoga* therapy for many psychosomatic diseases based upon ancient Indian *yogic* texts and *Taittiriya Upanishads*, operates on five sheaths (*pancakośa*) of the body those are *annamaya, prāṇāmaya, manomaya, vijñānāmaya* & *ānandāmaya kośa*.The disturbance in the *manomaya kośa* percolates into the physical layer (*annamaya kośa*) through the *prāṇāmaya kośa*. Hence, in the treatment of these psychosomatic aliments it becomes mandatory to work at all *kośas* to bring about the quick results. The integrated approach, therefore , consists in not only dealing with physical sheath, the relief of which could at

best be temporary as in happening with the drugs used in modern medicine to treat disease of psychosomatic diseases like HT, DM, asthma etc. it also includes applying techniques to operate on different sheaths of the body.

3.2.5.1. ANNAMAYA KOŚA

Annamāya kośa practices are healthy *yogic* diet, *kriyās*, loosening excises & *yogāsanas* are used to operate at the *annamāya kośa* level.

Kriyās:

These are *yogic* processes described in *haṭha yoga* to cleanse the inner organs of the body. They produce the following effects (1) Activating & revitalizing the organs (2) Toning up their functions, (3) Desensitization and (4) Development of deep internal awareness.

Sithilakaraṇa vyāyāma:

Very simplified physical movements to mobilize and activate the affected part of the body are used. Some easy physical exercises are adapted to satisfy the needs for the particular ailments to (a) loose the joint (b) stretch and relax the muscles, (c) improve the power and (d) develop stamina.

Yogāsanas:

Yogāsanas are physical posture often imitating the natural positions of the animals meant to reach the mind tranquil. Through these posters, the physical revitalization and deep relaxation and mental calmness are achieved.

Relaxation techniques:

The literature on the use of relaxation or relaxation-like procedures (relaxation therapy) in the treatment of hypertension was critically reviewed. Relaxation therapy resulted in greater reduction of blood pressure[46].

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[47].

Sātvic food:

Sātvic food are those that make the mind *sātvic, sātvic* food makes man pure & happy, gives vitality & stamina to the mind & promotes positive health. This includes simple vegetarian diet containing sufficient proportions of nutrients with minimal spices & fats. It should also be cooked fresh & serve with good heart. Here the concept of moderation in quantity & quality is very important.

आयुः सत्वबलमारोग्यसुखप्रितिविवर्धनाः।

रस्याः स्निग्धाः स्थिराः हृद्याः आहाराः सात्विकप्रि याः ॥ भ गी १७।८

āyuḥ satvabalamārogya*sukha*priti vivardhanāḥ ।
rasyāḥ snigdhāḥ sthirāḥ hṛdyāḥ āhārāḥ sātvikapri yāḥ ।।Bha Gī 17/8

Those food which increases the *āyu* (Life & vitality), *sattva* (purity), *bala* (strength & stamina), *ārogya* (Health), *sukha* (Happiness) and *priti* (Cheerfulness), those foods are *rasyaha* (Savoury), *snigdha* (oleaginous), *sthira* (Substantial), *hṛidya (agreeable)* and are liked by the *sattviks.*

3.2.5.2. PRĀṆĀMA YA KOŚA

Prāṇa is the basic life principle. *Prāṇayāma* is a process of gaining control over *prāṇa*. The five manifestations of *prāṇa* and the corresponding most comprehensive definition of *prāṇayāma* in the human system are described in *prasnopanishat*. Suitable types of *prāṇayāma* and breathing helps to get rid of the random agitations in *prānic* flows in the *prāṇāmaya kośa*. Hence, the aliments are handled at this *prāṇāmaya kośa* level.

Prāṇayāma:

The alternate nostril breathing *prāṇayāma* showed that there was a significant decrease in systolic and diastolic blood pressure and an improvement in Purdue pegboard task scores for both hands & also breath awareness breathing practice showed significant reduction in systolic blood pressure[81].

praṇava prāṇayāma showed reduction in systolic pressure (SP) and a more significant ($P < 0.01$) reduction in HR, pulse pressure and double product (Do P). The reduction in rate-pressure product (RPP) was highly significant ($P < 0.001$). *praṇava prāṇayāma* is effective in reducing HR and SP in hypertensive patients within five minutes of the practice & decreased sympathetic activity and improved baroreflex sensitivity along with an augmentation of endogenous nitricoxide production[48].

3.2.5.3. MANOMAYA KOŚA

A direct operation on this level is made possible by the last three limbs of *astānga yoga* of *Patanjali- dhāraṇa, dhyāna*, and *samādhi*. The culturing of mind is accomplished by focusing of the mind (*dhāraṇa*) initially, followed by relaxing dwelling of the mind in a single thought (*dhyāna*) for longer duration leading ultimately to super consciousness (*samādhi*).

Meditation:

Transcendental meditation showed decreases in autonomic variables like blood pressure, heart rate & heart rate[49].

There is evidence to indicate that mindfulness meditation can lower blood pressure; mindfulness-based stress reduction (MBSR) programs are based upon a dynamic awareness of physical and mental states & it's also improving psychological and physiological health effects in healthy individuals (Palta P, Page G, Piferi RL, Gill JM, Hayat MJ, Connolly AB, 2012).

3.2.5.4. VIJÑĀNĀMAYA KOŚA

A basic understanding of the key to operate from *vijñānāmaya kośa*, the *ūpaniśats* are the treasury of such knowledge which is the redeemer of all miseries and obsessions. It is the lack of that inner *jñāna* which is responsible for many wrong habits, agitations, etc. The happiness analysis-*ānanda mimausa* of the *taitteriya ūpaniśat* handles the most fundamental problems relevant to all living creatures. The *ānandāmaya kośa*, it helps the person to change this attitude of greed and deep attachment to material possessions and greed and enjoyment towards the realization that happiness is within and 'each one of us' in our causal state is '*ānanda*' embodied.

3.2.5.5. ĀNANDAMAYA KOŚA

To convey the bliss to the causal body (*kāraṇa śarira*) called *ānandamaya kośa* in all actions is the key for a very happy and healthy life. This also brings innate healing powers to affect, a complete cure of aliments.

3.2.6. KRIYĀS, A PART OF IAYT[50]

Introduction:

Kriyās are cleansing practices. In that sense, *Yogic kriyās* refer to special techniques meant to cleanse the inner organs, developed by the *yogis*. Among several *kriyās* available in the *yogic* lore 6 major *kriyās* are called *śatkriyās* are quite comprehensive.

They are;

(1) *Trāṭaka*- for eyesight.

(2) *Neti*-for upper nasal track (from throat to nostrils).

(3) *Kaphālabhāti*- for lower respiratory track (from nostril to lung).

(4) *Dhauti* -for upper gastrointestinal tract up to stomach.

(5) *Nauli*-for abdominal viscera.

(6) *Basti*- for lower gastrointestinal tract especially the rectum (*śankha prakśālana* for the entire GIT).

Objectives

1) Cleanse the inner tracts namely the optical path, respiratory tract & G.I.T., and thereby refresh the internal passages.
2) Develop an internal awareness.
3) Desensitization the possible hypersensitivity reactions in the pathway.
4) Ramp up the stamina and forbearance capacity.

3.3. IMPORTANCE OF BOWEL CLEARANCE IN MANAGEMENT OF NCDs-

3.3.1. ĀYURVEDA:

Role of *doṣa* in manifestation of diseases, *Āyurveda* considers all the diseases are products of imbalance in the *doṣa.* The main cause for this imbalance in the *doṣa* is *āhāra vihāra* and *vicāra* (life style). This wrong life style will leads to formation of *āma* (toxins) in the body which causes obstruction in the *srotas* (channels) and leads to imbalance in the *doṣa*.

3.3.1.1. Concept of *āma in Āyurveda*:

Different definition of *āma* according *Āyurveda*.

ऊष्मणोऽल्पबलत्वेन धातु माद्यामपाचितम् ।
दुष्टमामाशयगतं रसमामम प्रचक्षते॥
अन्ये दोषेभ्यः एवाति दुष्टेभ्योऽन्योन्यमूर्छनात्।
को द्रवेभ्यो विषस्येव वदन्त्यामस्य सम्भवम्॥ अ ह्र सू १३।२४

ūṣmaṇo'alpa balatvena dhātu mādyāmapācitam।
duṣṭamāmāśaya gataṁ rasamāmaṁ pracakṣate।।
anye doṣebhyaḥ evāti duṣṭebhyo'nyonyamūrchanāt।
kodravebhyo viṣasyeva vadantyāmasya sambhavam।। A Hṛ Sū 13।24

Due to hypo-function of *ūṣmā (agni)*, the food which is not completely digested, yields immmature *rasa* in *āmāśaya* and due to its retention, undergoes fermentation. The resulating substance called *āma*. Other description of *āma* refres to *āma* that is produced in *āmāśaya,* the word *āma* also has a generalized meaning which can be applied to any sort of working *agni* in body.

आमाशयस्थः कायाग्ने दौर्बल्यादविपाचितः।

आद्यम् आहारधातुर्यः स आम इति किर्तितः॥ मा नि २५।१

āmāśayasthaḥ kāyāgne daurbalyādavipācitaḥ।

ādyam āhāradhāturyaḥ sa āma iti kirtitaḥ। Mā Ni 25।1

Due to the feebleness of *kāyagni*, the *āhāra rasa* is not properly formed in the *āmāśaya* and in this state it is know as *āma*. In other sense it is also told that the first *dhātu* i.e. *rasa dhātu,* if not formed properly, then this uncovered *rasa dhātu* is termed as *āma*.

आहरस्य रसः शोषो यो न पक्वोऽग्निलाघवात्।

स मूलं सर्वरोगाणाम् आम इत्यभिधीयते॥ मा नि २५।१३

āharasya rasaḥ śoṣo yo na pakvo'gnilāghavāt।

sa mūlaṁ sarva rogāṇāṁ āma ityabhidhīyate।। Mā Ni । 25।13

The final product of the *āhāra rasa* which does not get properly transformed due to feeble digestive fire is called *āma* and is considered as the root cause of all diseases.

Hence *āma* can be considered as an undigested or partially digested/metabolised substance which requires further process *(pariṇāma)* and if retained as such it may produce impairement in the micro and macro channels of the body (*srotovaiguṇya*). This ultimately leads to accumulation of the provoked *dośa's* converting it in the form of any disease. Thus, *āyurveda* has given much importance to the concept of *āma* than *āmaya* (disease) which is only the end product of accumulation of *āma*; *āma* in all acute, sub-acute or chronic conditions relates to the gastro-intestinal as well as metaboloc disturbances engendered due to impairment of *antarāgni*.

In particular, and hence said to be a toxic by product (generated due to improper digestion) that results in diseases. These can be correlated to different types of cellular toxins, reactive oxygen species and excessive inflammatory markers.

Properties of āma (āma guṇa's):

अविपक्वमसम्युक्तं दुर्गन्धं बहुपिच्छिलं।

सदनं सर्वगात्रणाम् आम इत्यभिधियते॥ (अरुणदत्त अ ह्र सू १३)

Avipakva masamyuktaṁ durgandhaṁ bahuapicchilaṁ।

sadanaṁ sarvagātraṇāṁ āma ityabhidhiyate।(Aruṇadatta A Hṛ Sū 13)

Avipakkvam (incompletely transformed) – This property of *āma* is quite clear from the definition and etymology of *āma*. The production *āma* occurs due to malfunction of *agni;* the undigested or improperly digested substance lies in incomplete metabolic state; this is termed as *āma;* this is described by the word *avipakkvam*.

Asamyuktaṁ (non-homogeneous) – Though *āma* has properties like *picchila* (slimy) and *snigdhata* (unctuous) due to which it sticks quickly to the other body tissues, *asamyuktaṁ* property refers to the stage of *āma* when it is just formed and is non-assimilable to tissues due to incomplete metabolism. at this stage *āma* lies in its free state, and after some time if not digested or excreted from the body, adheres to tissue. Thus , the intermediate state, when it lies freely in the tissue is indicated by *asamyuktaṁ*.

Durgandhaṁ (Foul smelling) – Every *dravya* in the body has its specific odor. Though *āma* is also made up of same *dravya's* there is a change in normal structure due to incomplete metabolism. As a result of these changes in structure it has different smell than normal body structure and usually this smell is foul in nature. Also due to fermentation and putrification occurring in the formation of *āma* it has bad odor. This property of *āma* is descibed by *durgandhaṁ*.

Picchilam (slimy) According to *hemadri,* definition of *picchila guṇa* is *yasya lepane śaktiḥ sa piccilaḥ* i.e. that substance which is capable of coating is called is called as *picchil*a. Due to this property *āma* sticks to healthy body tissue. Due to this property it adheres to the *srotas*, to different *dośa dusya* and *malas* (*vagbhaṭa*).

Sadanaṁ sarvagātrāṇāṁ : *āma* has *drava guṇa* (*caraka*) and due to this property *āma* spreads in every part of body.

Symptoms of āma accumulation in the body (āma lakṣaṇās):

स्रोतोरोधबलभ्रंशगौर वानिलमूटता :।

आल स्यापत्तिनिष्ठिवमलसङ्गारुचिक्लमाः॥ अ ह्र सू १२।२३

srotorodhabalabhraṁśagaura vānilamūṭatā।

āla syāpattiniṣṭhivamalasaṅgāruciklamāḥ। A hṛ Sū 12।23

Srotorodha (Obstrution in the channels of circulation) – Normal functioning of *srotas* is very important in maintaining health. Due to the properties like *picchilam, snigdhata* etc *āma* adheres to walls of *srotas* and as aresult the lumen of *srotas* becomes narrowed. Once this narrowing of lumen

occurs, the normal functioning of *srotas* gets disturbed and this leads to disease. This mechanism is common to both micro and macro channels, and accordingly disease of that particular *srotas* is produced.

Balabhraṁśa (loss of strength): It is due to the systemic effect of *āma* that circulates in the body. *Balabhraṁśa* also occurs because of lack of proper nutrition; thus the working power of *dośa, dhātu* and *mala's* throughout the body is reduced that results in *balabhraṁśa*.

Gaurava (Heaviness): *āma* causes heaviness in the whole body and/or different parts of the body. When *āma* accumulates at different sites this heaviness is felt.

Anilamūṭatāḥ (restricted movement of *vāyu*): *āma* causes *srotorodha* in *srotas* and hence there is an obstruction to the normal flow through the lumen. Due to *srotorodha*, free flow of *vāyu* becomes obstructed and that condition is termed as *anilamūṭatāḥ*.

Ālasyā **(**Stupor): This due to psychological effect produced by the presence of *āma* along with its effect of *guruta* etc. Patient suffering from *āma* gets disturbed psychologically and becomes unable to perform this normal body activity, which is known as *ālasyā.*

Apatti (Incomplete digestion): The production of *āma* sets off a vicious circle. Due to this *agnimāndya āma* is produced. Now this *āma* again causes further *agnimāndya* and hence this symptom of *appetite* is seen. It appears to refer to metabolic impairment taking place due to effect of *āma* at micro level.

Nisṭhiva (Spitting/expectoration): When food is not digested properly a reflex is set which increases salivary secretions and results in frequent spitting.

Malasanga (obstruction to the movement of waste products): This is again due to s*rotorodha* at *mahasrotas* level. Also due to properties of *picchilam, snigdhata* and *guruta*, the *mala* (waste product) produced after completion of *jaṭharāgni*, sticks to the walls of intestines and is difficult to expel out. At micro levels also the same processes occur. Due to *srotorodha* and sticking nature of *sāma mala*, *malasanga* takes place.

Aruci : This shows the effect of *sāma* (associated with *dośa/dhātu/ mala* with *āma*) over psyche. Due to improper digestion etc. Patient have loss of desire for taking food.

klamāḥ (Debility): In this state patient feels exhausted without doing work. Again this is due to damage caused in the entire body by the circulating *āma*.

There are the main symptoms produced due to presence of *āma* in the body at various levels. The association of these symptoms along with signs and symptoms of disease help in diagnosing a disease as *sāma* or *nirāma* . The treatment of a disease is based on this diagnosis.

TYPES OF ĀMA:

Sāmavāta:

वायः सामो विबन्धग्निसादस्तन्द्रान्त्रकुजनौः।

वदनाशोथानिरस्तोदौः क्रमशोऽङगानि पिढयेत्॥

विचरेत युगपत् चापि गृह्वाति कुपितो भ्रुशम्।

स्नेहाद्यैव्रुद्धिमाप्नोति सुर्यमेघोदयेनिशि॥ माधव निदान मधुकोश १।४

vāyaḥ sāmo vibandhagnisādastandrāntrakujanauḥ।
vadanāśothānirastodauḥ kramaśo'ṛagāni piḍhayet।।
vicareta yugapat cāpi gṛhvāti kupito bhruśam।
snehādyaivruddhimāpnoti suryameghodayeniśi।। mādhava nidānamadhukośa 1।4

Sāmavāta produces obstructions in the passages and various movements of organs and channels. This produces symptoms such has loss of appetite, drowsiness, borboregmi, pain, edema, pin prick sensation, peeling type of pain in the body and /or pain in different parts of the body. These symptoms are aggravated by oleation in the morning, at night, and during cloudy time.

Nirāmavāta:

निरामो विषदो रुक्षो निर्विबन्धोऽल्पवेदनः।

विपरितगुणौ शान्तिम् स्निग्धौर्याति विषतः॥ माधव निदान मधुकोश १।४

nirāmo viṣado rukṣo nirvibandho'lpavedanaḥ।
viparitaguṇau śāntim snigdhauryāti viṣataḥ।। mādhava nidāna madhukośa 1।4

Nirāma vāta is a state of vitiated *vāta* in which obstruction due to *āma* is removed. Therefore it shows only the symptoms of aggravation of *vāta* and not those of abnormal movements or actions. Hence aggravation of the normal qualities of *vāta* is observed e. g. Dryness, mild pain and ache etc. which can be removed by oleation treatment.

As *āma* is the root cause of all the diseases so in order to treat the diseases one should get rid of the accumulated *āma* first and then should avoid the all possible causes of *āma* formation.

Treatment of āma *(āma cikitsā):*

आमं जयेल्लङ्घनं कोष्ण पेय लघ्वन्नरुक्षौदनतिक्तयुषौः निरुहेनैः स्वेदनपाचनैश्चसंशोधनैरूर्ध्वम् अधःस्ततः॥ योगरत्ना करः॥

āmaṁ jaye llaṅghanaṁ koṣṇa peya laghvanna rukṣaudana tikta yuṣauḥ niruhenaiḥ svedana pācanaiśca saṁśodhanairūrdhvam adhaḥstataḥ।। yogaratnā karaḥ

āyurveda explains several remedies for *āma* treatment which involves three main procedures. First is the use of *laṅghana* (fasting) which helps in load shedding on *agni* and arrest the formation of *āma*. Second is the use of *dipana dravya* (fire enhancer) which helps in improving the status of *agni* and enhancing its action. Next is *pācana*, done with *pācana dravya*. *pācana dravya* (appetizer) helps in digestion of already produced *āma*. The last step is *samśodhana* (purificatory procedures) which involves the use of purificatory procedure in order to remove out the *āma* which is accumulated. In *pancakarma virecana* (therapeutic purgation) is one of purificatory process to expel toxins through the rectum.

Definition of Virecana:

तत्र दोषहरनमोर्ध्वभागम् वमन सन्ध्यकम् अधोभागम् विरेचन सन्ध्यकम् ॥ च क १।४

tatra doṣaharanamoordhvabhāgam vāma na sandhyakam adhobhāgam virecana sandhyakam ।। *Ca Ka* 1/4

Virecana is defined as the act of expelling *doṣa* through *adhobāga*[51] (anal route)

विप क्कं यदप क्कं वा मलध्य द्रव तं नयेत्।

रेचयत्यापि तध्येयं रेचनं त्रिवृतो यथा श पु ४।६

vipakvam yadapa kvaṁ vā maladhya dravā taṁ nayet।
recayatyāpi tadhyeyaṁ recanaṁ trivṛto yathā ।। *Sha Pu* 4/6

The process of expelling of the morbid *doṣas* out of the body in the form of *drava* either *pakva* or *apakva* state.

विरेको मुखपेतम् गुदमार्गेनतः स्थितस्य दोष निस्सरनम् ॥ अ हृ सू १।२५

vireko mukhapeetam gudamārgenataḥ sthitasya doṣa nissaranam ।। A Hṛ Sū 1।25

Virecana is the procedure in which the drug is administered through oral route which acts on morbid *doṣas*, especially on *pitta* & expelled them out through anal route[52].

पित्ते तु विरेकम् श्लेष्मा संश्रुते वा स्थानगते वा श्लेषानिति । अ स सू २७।४

pitte tu virekam śleṣmā saṁśrute vā sthānagate vā śleṣāniti । A Sa Sū 27।4

Virecana is good for *pitta* vitiated diseases.

व्याकु लान् सन्निपातोथानपैत्ति कान् कफ पैत्ति कान् ।

संश्रुतान् कफ मूलं च स्रंसनेन अभ्युपक्रमेत ॥ क सि ७

Vyāku lān sannipātothāna paitti kān kapha paittikāna।
saṁśrutān kaphā mūlaṁ ca sraṁsanena abhyupakrameta ।। *Ka Si* 7

Virecana is the best line of treatment modality for *pitta doṣa* (Ca sū 25/40) also it act on *kaphasamsrusta pitta* or *pittasthanagata kapha*. And moreover in case of *vātasyopakarma mṛdhu shodhana* indicated which refers to *mṛdhu virecana karma* (A Hṛ Sū 13/1). Hence *virecana* is the major line of treatment for morbid *pitta doṣa* & also it acts on morbid *kapha* & *vāta doṣa*. Thus the action of *virecana* can be observed on all the *tridoṣas*.

Procedure of Virecana:

Pancakarma is the detoxification method of body, it included five different procedures to remove toxins from body through different paths of the body, among them *virecana* is the method to remove *āma* or vitiated *pitta* through anal route.

Steps of Virecana:

1) ***Dipana & pācana:***

Oral administration of *dipana* (fire enhancers) & *pācana* (appetizers) medications,

2) ***Snehana* (oiliation therapy)**

Two types of *snehana*

A) *Abhyantara sneha*: Internal administration medicated ghee or oil *(snehana)*

B) *Bāhya sneha:* External application of medicated oil or ghee.

3) ***Svedana* (sudation therapy)**

Inducing the perspiration to liquefy the *āma* and to remove the obstruction from the channels,

4) ***Virecana* (therapeutic purgation)**

Elimination of excess *doṣas* and *āma* through anal route of administration of medicines like *danti, dravanti, trivṛta, āragvada, triphalā* etc.

TRIPHALĀ

Suśruta mentioned *triphalā* as a specific *gaṇa* (specific group of medicinal herbs having similar properties). Description of *triphalā* and its application is found in all *āyurvedaic* texts. It is often said by traditional *vaidyas* that *triphalā* alone can treat 50% of cases in clinical practice;

Triphalā is a group of three medicinal fruits they are:

(1) *Haritaki* (Terminalia chebula)

(2) *Āmalaki* (Emblica officinalis)

(3) *Vibhataki* (Terminalia bellirica)

These are also known as *'phala traya or 'varga'*.

It is essential to note that the ratio in which *the 3 phalās* are to be mixed is not quite clear.

According to *suśruta*	: *Haritaki: āmalaki: vibhataki*	= 1:1:1
According to *Bhavamishra*	: *Haritaki: āmalaki: vibhataki*	= 1:1:1
According to *cakradatta*	: *Haritaki: āmalaki: vibhataki*	= 1:2:4
According to *yogaratnākar*	: *Haritaki: āmalaki: vibhataki*	= 1:2:4

The traditional approach is to accept an equal volume or the weight of the fruit pulp (dried) i.e., 1:1:1.

Properties of *triphalā* : *kapha pittahara, cakcuśya, rasāyana*

Indications: *prameha, kusta, agnimāndya, netraroga, viśāma jvara, śotha, kapha pittahara, cakcuśya, rasāyana, prameha, kusta, agnimāndya, netraroga, viśāma jvara, śotha, malaband*[53 ,54 ,55 , 56.]

According to research evidence, *triphalā* has a wide spectrum of medicinal value with be diuretic effect in nature, mild laxative effect studies have shown that it prevents functional constipation in healthy individuals[57], prevents bleeding in bleeding piles[58], has antidiabetic[59], anticataract[60], anticarcinogenic[61], antibacterial[62], antidental plaque[63], ant gout[64] properties; wound healing[65] and enhances the liver and spleen functions[66], prevents radiation induced acute intestinal mucosal damage[67], inhibits vascular endothelial growth[68] and may prevent the occurrences of stroke[69]; reduces bronchial hyperactivity and immune modulation[70].

Haritaki

Vibhitaki

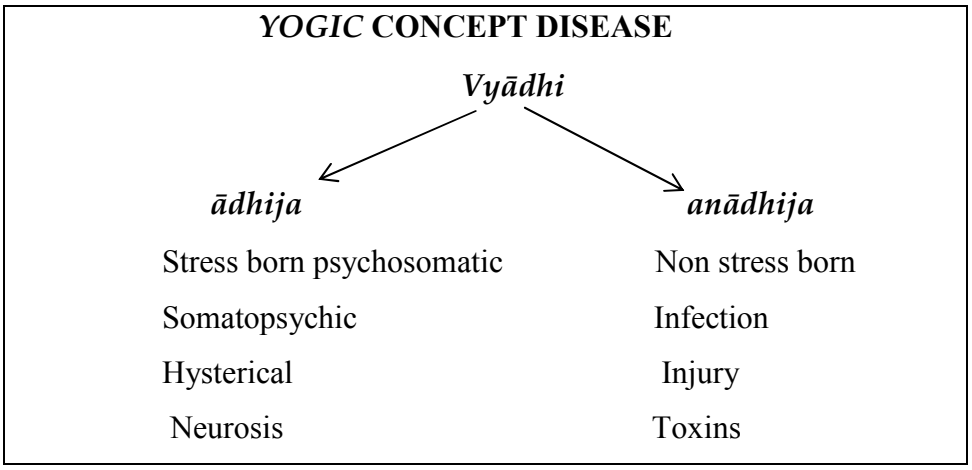
āmalaki

Fig.1. Three fruits *of triphalā*

3.3.2. YOGA

3.3.2.1. *Vyādhi* according to yoga[92]:

In *ānandamaya kośa* a man is healthier with perfect harmony and balance of all these faculties. At *vijñānamaya kośa* there are movements, but are channeled in the right direction. As such, it is at the *manomaya kośa* level the imbalance start, say the *yoga* texts. Likes and dislikes have come to play at this level. They start governing our actions; often they are in the wrong direction. The liking of Sweets in a diabetic may lure him to eat the same against doctor's advice. Thus going against what is right causes imbalances. These imbalances amplify themselves resulting in the mental illness *ādhis*. At this stage there are no symptoms at the physical level. Prompted by the perpetual growth of desires, these mental diseases concealed in us, begin to manifest themselves externally and gradually they percolate to the physical frame. Preponderance of *ajñāna* (ignorance about once's real state of bliss) leads one to perform wrong actions such as eating of unwholesome food, living in unhealthy dwellings, doing things at untimely hours, the association with the wicked, evil thoughts, inflict injuries, etc. These breed physical diseases called *vyādhis* or secondary diseases.



Schematic presentation of *yogic* concept disease

The *ādhis* (primary diseases): are two fold- *sāmānya* (ordinary) and *sāra* (essential). The former includes the diseases incidental to the body while the latter is responsible for rebirth to which all men are object. The *sāmānya* are normally produced during the interactions with the world. These may be termed as psychosomatic ailments. When dealt with by suitable techniques and congenital atmosphere, *ādhis* of the ordinary type will vanish. Along with it are destroyed the physical

ailments i.e., the *vyādhis* caused by these *ādhis, ānadhijāh-vyādhayah*. The subtler *ādhis* of the essential type (*sāra*) which cause the birth of the physical body can be destroyed only by the realization of the causal state of mind and a corresponding ability to live in *vijñānamaya* and *manomaya kośa*. In that state, man transcends the cycle of birth and death.

The *ānadhijāh* (Secondary): Those not originated by the mind. These would probably include the infections and contagious diseases. The text says that *ānadhijāh vyādhayah* can be handled through conventional medicine (the chemotherapy of modern medicine and *āyurveda*), *mantras* (with their natural vibrational characteristic) and good actions. These bring about the purity of mind, the *prāṇa* flowing freely in the body and the food getting digested better and assimilated properly allowing the diseases to vanish.

The psychosomatic illness:

Among the two types of *ādhis* described the *sāmānya* (ordinary) type corresponds to the modern psychosomatic ailments. When the mind is agitated during our interaction with the world at large, the physical body also follows in its wake. These agitations cause violent fluctuations in the flow of *prāṇa* in the *nāḍis*. The *prāṇa* flows in the wrong paths flying from one to the other without rhythm and harmony. The *nāḍi* can no longer, in this condition, maintain stability and steadiness, but quiver. Due to these disturbances of the *prāṇa* and unsteadiness in the *nāḍis*, the food does not get properly digested.

***Kujirṇatvam* :**

Wrong digestion of food due to imbalance in flow of *prāṇa* in *annamaya kośa* level.

***Ajirṇatvam* :**

Indigestion /or non-digestion of food because of imbalance flow of *prāṇa.*

***Atijirṇatvam* :**

Over digestion of food in *annamaya kośa* level because of imbalance flow of *prāṇa.*

3.3.2.2. **Cikitsa**[71]:

***Laṅghana* (fasting):**
Depends upon body composition fasting will be advisable under the guidance of physician.

samśodhana (Purificatory procedure):

आकण्ठं पूरयेद्वारि वक्त्रेण पिबेच्छनैः।

चालयेदुदरेणैव चोदराद्रोचयेदधः॥ घे सं १।५४

ākaṇṭhaṁ pūrayedvāri vaktreṇa pibecchanaiḥ ।

cālayedudareṇaiva codarādrocayedadhaḥ ।। ghe saṁ 1।54

Laghu śankhaprakśālana can be correlated with *vārisāra dhauti* which according to *ġheranḍa saṁhitā* is one of the types of *antaradhauti.* In *vārisāra dhauti* the mouth is filled with water and drank slowly; then forced down through the stomach, and expelled downwards through the rectum. *Vārisāra dhauti* is said to be the highest *dhauti* and one who practices it with ease, purifies his filthy body and turns it into a shining one[94].

The commentator of *haṭhayoga pradipika, Swami Muktabodhananda*, he correlated the *varisāra dhauti* to *śankhaprakśālana*[72]. In this practice the practitioner should drink stomach full of water and evacuate it through the bowel by performing a series of practices like waist rotation, spinal twist, *utkatāsana*, *ardha katichakrasana*, heal & toe walk, crow walk etc. And after every two glasses of water the asana should be performed until the water starts flowing out through the anus. Once clear water starts coming through anus then practice is stopped & then rest is advised.

There is a shorter technique called *laghu śankhaprakśālana. Laghu* means 'short'. In this practice drink stomach full of water once then perform a series of practices & evacuate it through the bowel. But according to *haṭhayoga pradipika*, this cleansing process mentioned as *basti*,

नाभिदघ्नजले पायो न्यस्तनलोत्कटासनः।

आधाराकुचनं कुर्यत्क्षालनं बस्तिकर्म तत् ॥ ह प्र २।२६

nābhidadhnajale pāyo nyastanalotkaṭāsanaḥ।

ādhārākucanaṁ kuryatkṣālanaṁ bastikarma tat ।। H Pra 2/26

Sitting in *utkaṭāsanaḥ*, navel deep in water, insert a tube into the anus and suck the water into the intestine. This cleansing with water is called *basti*.

3.3.2.3. IMPORTANCE OF *ṢANKHAPRAKŚALANA*

गुल्मप्लिहोदरं चापि वातकफोद्भव ।

बस्तिकर्म प्रभावेण क्षीयन्ते सकलामया॥ ह प्र २।२७

gulmaplihodaraṁ cāpi vātakaphodbhavā।

bastikarmaprabhaveṇa kṣīyante sakalāmayā।। H. Pra 2/27

Enlargement of the glands and spleen, and all disorders arising from excess *vāta, pitta* and *kapha* are eliminated from the body through the practice of *basti*.

धात्विन्द्रियान्तः कारणप्रसादं दधाच्च कान्तिं दहनप्रदीप्तिम्।

अशेष दोषोपचयं निहन्यादभ्यस्यमानम् जलबस्तिकर्म॥ ह प्र २। २८

dhātvindriyāntaḥ kāraṇaprasādaṁ dadhācca kāntiṁ dahanapra dīptim।

aśeṣadoṣopacayaṁ nihanyādabhyasyamānam jalabastikarma।। H.Pra 2/28

By practicing *jalabasti* the appetite increases, the body glows, excess *doṣas* are destroyed and the *dhātu*, sense and mind are purified.

3.4. LITERARY REVIEW FROM CONTEMPORARY SCEINTIFIC PUBLICATIONS

3.4.1. AYURVEDA FOR HTN:

Āyurved are commends lifestyle change as the foremost measure before administration of any of the herbal preparations for all diseases. Strong recommendations of dietary changes, activity and sleep pattern are prescribed. Importance is given to cleansing practices called *panchakarmas* that emphasize on bowel cleansing as the main therapy. Several useful herbal preparations have been shown to be beneficial in HTN which is elaborated below.

3.4.1.1. Arjuna for cardiovascular diseases:

The effect of Terminal *Arjuna* in chronic stable angina: a double-blind, placebo-controlled, crossover study comparing Terminalia *Arjuna* with isosorbide mononitrate. Fifty-eight males (n=58) with chronic stable angina (NYHA class II-III) with evidence of rovo cable ischemia on treadmill exercise test received Terminalia *Arjuna* (500 mg 8 hourly), isosorbide mononitrate (40 mg/daily) or a matching placebo for one week each, separated by a wash-out period of at least three days in a randomized, double blind, crossover design. They then underwent clinical treadmill tests showing significant (P<0.003) decrease in the frequency of angina[73]

Another study showed increased cardiovascular endurance and lowered systolic blood pressure with significant (p<0.005) attenuation of cardiac dysfunction and myocardial injury in diabetic rats (n=50). It also reduced body weight, heart rate, blood pressure, oxidative stress, ET-1, and inflammatory cytokine levels[74].

An experimental study was carried out in 50 dogs by ligated coronary artery and terminal *Arjuna* decoction was administered. 25 dogs were taken as treatment group and 25 dogs were kept as a control group for one month. At the end of the study histopathological evaluation was done which revealed that *Arjuna* significantly (p<0.005) regenerated the cardiac tissue in the infarct area. After carrying out coronary angiography in dogs treated with *Arjuna* it was noticed that new coronary vessel developed (Gupta L.P.; "Studies on cardiac muscle regeneration under the influence of certain indigenous drug,"Ph. D, thesis, Wellpark collage, Auckland, 1972).

Dwivedi S., et.al study was observed that *Arjuna* (T. Arjuna) significantly (p<0.001) decreased the elevated cholesterol and increased the level of HDHL Cholesterol. It was noted that the prostaglandin levels which were low have been increased and high levels of catecholamines were brought down by the administration of the drug bedsides relief from symptoms like pain, palpitation (Dwivedi S., 1986). And diet-induced hyperlipidemia rabbits were shown decreases in TCL, LDL & TG levels by administering 50% ethanolic extract of Terminalia *Arjuna*. The extract did not show any adverse effect on liver and renal function and hematological parameters[75].

3.4.1.2. Herbomineral compound for HTN*:*

In this study, the efficacy herbomineral medicine i.e. *Rakatchaphar* (Each 500 mg cap contains *Sarpgandha* 150 mg, *Shankhpushpi* 75 mg, *Jatamansi* 75 mg, *Jahar Mohra Khatai Pishti* 75 mg, *Moti Pishti* 75 mg, *Ras Sindoor* 50 mg) was seen in essential hypertension, an observational prospective single group pre-post study was done on ninety-eight patients in the age group 28–76 years with essential hypertension without any co-morbid illness was included in the study. Patients were treated with cap *Rakatchaphar* 500 mg twice a day. Blood pressure (BP) was monitored on subsequent follow-up visits at 2, 4, 6, and 8 weeks. Change in Diastolic BP (DBP), Systolic BP (SBP), and Mean BP (MBP) were analyzed statistically by Student's *t* test, ANOVA, and Post hoc Bonferroni test. On the first visit the mean SBP, DBP, and MBP was

164.16±17.27, 101.88±9.20, and 122.27±10.57 mm Hg, respectively. After 8 weeks of therapy there was a statistically significant fall in SBP (122.98±11.36), DBP (80.90±8.57), and MBP (94.86±9.24) in mm Hg (*P* value <0.0001) [76].

3.4.1.3. *Makandi* for HTN:

This study showed effect of *makandi (Coleus forskohlii (Willd.) Briq) Ghana vati* and tablets of its powder in hypertension in the geriatric age group (50-80 years). A total of 49 hypertensive patients fulfilling the diagnostic criteria were registered in two groups- Groups I (*Ghana vati*) and Group II (*Churna* tablet). Out of 27 enrolled patients of group I, 21 patients completed the treatment. In Group II, out of 22 registered patients, a total of 20 patients completed the treatment for one month. The effect of the therapy was assessed on the basis of changes in the systolic and diastolic blood pressures, both sitting and supine positions. Analysis of the results showed that the treatment in both the groups had been found to be good. On a systolic blood pressure (sitting position) shows 12.07 and 10.75% relief in groups I and II, respectively. The effect of the therapy on diastolic blood pressure (sitting position) shows 9.80 and 8.65% relief in groups I and II, respectively. The effect of the therapy on systolic blood pressure (supine position) shows 12.99 and 13.25% relief in groups I and II, respectively. The effect of the therapy on diastolic blood pressure (supine position) shows 10.10 and 10.75% relief in groups I and II, respectively. The effect of the therapy on pulse pressure (sitting position) shows 15.79 and 14.10% relief in groups I and II, respectively. The effect of the therapy on pulse pressure (supine position) shows 17.61 and 17.23% relief in groups I and II, respectively. Statistically in all these parameters, both groups have shown highly significant results (*P* < 0.001). On applying the unpaired 't' test for comparison, no significant results have been obtained[77].

3.4.1.4. *Ġokśura-punarnava basti* for HTN:

The study was planned to evaluate the effect of *ġokśura-punarnava basti* in the management of micro albuminuria in DM *(madhumeha)*. Eligible diabetic patients with urine albumin excretion between 30 and 300 mg in 24 h were randomly divided into two groups. *āsthapana basti* (decoction enema) of *ġokśura* and *punarnava kvātha* (decoction), *kalka* (paste), *taila* (medicated oil), *madhu* (honey), and *saindhava* (rock salt) for 6

consecutive days and *anuvāsana* (unctuous enema) of *ġokśura-punarnava taila* on 1st and 8th day by traditional *basti putaka* method was given in the study group. Tablet Enalapril 5 mg, twice daily for 30 days was given to the patients in the control group. The primary outcome measures were percentage change in the presenting complaints of diabetes, urine micro albumin, Blood Sugar Level (BSL), and Blood Pressure (BP). Enalapril showed 33.33% improvement (P<0.005), whereas *ġokśura-punarnava basti* showed 79.59% improvement in the presenting complaints of diabetes(p<0.001), urine micro albumin, BSL and BP. *ġokśura-punarnava basti* has shown superior results in the management of micro albuminuria in DM as compared to control drug[78].

3.4.1.5. Śirodhāra in HTN:

śirodhāra is a classic and a well-established *āyurvedic* procedure of slowly and steadily dripping medicated oil or other liquids on the forehead.

The study design was open labeled, comparing the baseline variables with values after *śirodhāra*. The subjects (*n* = 16) chosen were healthy human volunteers who gave an informed consent. *śirodhāra* was preceded by *Abhyanga* – whole body massage. The *śirodhāra* method was standardized for rate of dripping with peristaltic pump and temperature was controlled by a thermostat. Mood and stress levels were assessed by validated rating scales. The pre and post *śirodhāra* ECG and EEG records were evaluated. Student's paired "t" test was applied to the means + SE of the variables to calculate statistical significance at $P < 0.05$. There was a significant improvement in mood scores and the level of stress ($P < 0.001$). These changes were accompanied by a significant decrease in the rate of breathing and reduction in diastolic blood pressure along with reduction in heart rate. The relaxed alert state, after *śirodhāra*, was co-related to an increase in Alfa rhythm in the EEG[79].

3.4.1.6. Śilājit and cardiac functions:

This is a single group pre-post design study, in this study different concentration of *śilājit* (L. *Asphaltum*) was prepared in distilled water, a starting concentration of 1 ppm was chosen so that the highest concentration did not exceed 100–200 mg/L. The concentration of *śilājit* was logarithmically increased (1, 10, 100, and 1000 ppm). The

stock and working solutions of *śilājit* were maintained under refrigeration at 4–8°C during the course of this study.

Daphnia (*n=30*) were collected from the pond water from Ahmednagar College Campus and were maintained using pond culture method at ambient temperature in the laboratory till the completion of this study. The individual rhythm appears to be fairly constant during treatment with *śilājit* concentrations of 1, 10, and 100 ppm. A rapid increase in heart beat frequency was observed by using Olympus compound optical microscope using a countdown timer for with audible signal when the organism was treated with *śilājit* concentration above 1000 ppm. The frequency increase was so rapid that heart beats could not be measured manually. It was revealed that the frequency decreases by 7.65% at 1 ppm., 15% at 10 ppm, and 28.45% at 100 ppm treatments, respectively, indicating a negative chronotropic effect at low *śilājit* concentrations, whereas treatment with 1000 ppm showed a positive chronotropic effect[80].

3.4.1.7. Danshen in HTN*:*

Dried root of *Salvia miltiorrhiza Bunge* known as *Danshen*. *Danshen* has been known for its abilities towards improving body functions such as activating blood circulation and removing blood stasis. *Danshen* successfully used in China for treating cardiovascular diseases such as coronary heart disease[81] and 50 essential hypertensive pre-post study showed significant ($P<0.05$) decrease in systolic and diastolic blood pressure but no changes seen in the control group.

3.4.2. YOGA:

Several well designed randomized controlled studies on the effect of *yoga* as complementary to modern medicine have documented its benefits in non-communicable diseases in different branches of medicine i.e. psychiatry[82], neurology, Pulmonology[83], cardiology[84], gastroenterology and gynecology[85] etc. There are many studies that have shown the beneficial effect of different *yoga* practices in HTN.

3.4.2.1. Uninostril breathing and blood pressure:

In *surya anuloma prāṇāyāma* (SAV), 12 volunteers (average age 27.2±3.3, four males) were assessed before and after test sessions conducted on two consecutive days. On one day the test session involved practicing SAV *prāṇāyāma* for 45 minutes (SAV

session). During the test period of the other day, Subjects were asked to breath normally for 45 minutes (NB session). For half the patients (randomly chosen) the SAV session was on the first day and the NB session on the next day. For remaining six patients, the order of the two sessions was reversed. After the SAV session (but not after the NB) there was a significant ($P<0.05$, paired t test) increases in oxygen consumption (17%) and in the diastolic blood pressure (mean increases 9.4mm Hg) and a significant decrease in digit pulse volume (45.7%). The latter two changes are interpreted to be result of increased cutaneous vasoconstriction. After both SAV and NB session, there was a significant decrease in skin resistance (two factors ANOVA, Tukey test). These findings show that SAV has a sympathetic stimulating effect[86].

3.4.2.2. Om meditation and Heart rate:

The autonomic and respiratory variables were studied in seven experienced mediators [age range 29-55 years (mean ±SD, 42.3±9.8), with experience ranging from 5 to 20 years]. Each subject was studied in two type session- meditation (with a period of mental chanting of "*om*") and control (with a period of non-targeted thinking). The meditators showed a statistically significant reduction in heart rate ($p<0.001$, paired't' test) during meditation compared to the control period (paired t test). During both types of session there was a comparable increased in the cutaneous peripheral resistance ($p<0.05$, paired' test) [87].

3.4.2.3. Yoga and Physiological changes:

This is pre-post design conventional study on 40 physical education teachers who already had an average range of 8.9 years of physical training, 3 months residential *yogic* training produced significant reduction in weight and blood pressure, heart rate and respiratory rate, improved lung function. The data obtained at the end of 3 months was compared with that taken initially, using paired t-test (two-tailed).

There was a significant increase in PFR (6%), FEV ($P<0.01$, 16%), and FVC ($P<0.001$, 18%). Breathe holding time ($P<0.001$, 40%) and a significant reduction in heart rate ($P<0.05$), respiratory rate, systolic ($P<0.001$) and diastolic blood pressure ($P<0.01$) [88].

3.4.2.4. Syllables chanting and physiological changes:

In this study autonomic and respiratory variables were recorded in 12 volunteers [4 males, 8 females and age ranging from 25 to 40 years (Mean 30.1, SD 6.2 years)] in three of the sessions (1). Before, during and after a test period of mentally repeating a meaningful syllable 'OM' (MOM session) (2). A similar session except that the test period was spent mentally repeating a neutral work, 'one' (COM session) (3). A session with a non-targeting thinking (NT session). The subjects were familiar with both syllables, and had been meditating on 'OM' for 20 days. During the test periods of both MOM and COM sessions the rate of respiration (RR) ($p<0.05$) and heart rate (HR) decreased significantly ($p<0.001$) [(two factor ANOVA (RR), paired t test (RR, HR)]. Compared to the preperiod, the mental repetition of 'OM' (but not 'one') caused a significant decrease in the skin resistance level (SRL) (paired sample test) [89].

3.4.2.5. Breathing Techniques and Heart Rate Variability (HRV):

In this study 12 volunteers in the age 21 to 33 years (mean ±SD, 25.6±3.1 years) were recruited. Who were familiar with both *kapalabhati* and *nadisuddhi* practices and were assessed before and after each practice on separate days. The electrocardiogram (lead I) was digitized on-line and off-line analysis was done. The result showed significant increases in low frequency (LF) power ($P<0.01$) and LF/HF ratio while high frequency (HF) power was signed ($P<0.05$) lower following *kaphalabhati*. There were no significant changes following *nadishuddhi.* The results suggest that *kaphalabhati* modifies the autonomic status by increasing sympathetic activity with reduced vagal activity[90].

3.4.2.6. Yogic Guided Relaxation and autonomic variables:

One study on 35 male volunteers whose ages ranged from 20 to 46 years (M=27. 5, *S*D=4.7 yr.) was studied in two sections of *yoga* based guided relaxation and supine rest. Assessments of autonomic variables were made for 15 subjects, before, during, and after the practices, whereas oxygen consumption and breath volume were recorded in 25 subjects before and after both types of relaxation. The paired t test showed 25. 2% decrease in oxygen consumption after guiding relaxation ($P<.001$). Breath amplitude increased by 15.0%, after guided relaxation ($p<.01$). There was significant reduction in heart rate reduced by 9.7% ($P<0.001$) and skin conduction reduced by 35.6% ($P<0.05$) (paired sample t test) [91].

3.4.2.7. kaphālabhati *and HTN:*

The Single group pre-post design, 60 beats/min practice *kaphālabhāti* (KB) study showed non-significant increase in systolic & diastolic blood pressure after *kaphālabhāti* practice but 2 Hz frequency of *kaphālabhāti* practice in 32 male volunteers with group showed an increased heart rate by 9 beats per min during KB. SBP and DBP increased ($p<0.05$) during KB by 15 and 6 mmHg respectively by practicing KB and showed decreased sensitivity of arterial baroreflex[92].

3.4.2.8. Review study:

Academic Search Premier, AltHealthWatch, BIOSIS/Biological Abstracts, CINAHL, Cochrane Library, Embase, MEDLINE, PsycINFO, PsycARTICLES, Natural Standard, and Web of Science databases were screened for controlled studies from 1966 to March 2013. Two authors independently assessed risk of bias using the Cochrane Risk of Bias Tool. All 17 studies included in the review had unclear or high risk of bias. *Yoga* had a modest but significant effect on systolic blood pressure (SBP) (−4. 17 [−6. 35, −1. 99], P = 0.0002) and diastolic blood pressure (DBP) (−3. 62 [−4. 92, −1. 60], P = 0.0001). Subgroup analyses demonstrated significant reductions in blood pressure for (1) interventions incorporating 3 basic elements of *yoga* practice (postures, meditation, and breathing) (SBP: −8. 17 mm Hg [−12. 45, −3. 89]; DBP: −6. 14 mm Hg [−9. 39, −2. 89]) but not for more limited *yoga* interventions; (2) *yoga* compared to no treatment (SBP: −7. 96 mm Hg [−10. 65, −5. 27]) but not for exercise[93].

CHAPTER 4

4. MATERIALS AND METHODOS

4.1. SUBJECTS

4.1.1. SAMPLE SIZE

A sample size of 32 was calculated by using the G power software computing the values for alpha at 0.06, effect size of 0.5 powers at 0.8. The effect size was calculated by considering the mean and standard deviation before and after the *yoga* intervention in hypertension patients who were treated in the same inpatient setting in our pilot study on 10 subjects and intervention given 2nd and 5th days **(**Pre systolic 150.4±10.5, post systolic 128.2±14.5, and pre diastolic 87.6±5.8, post diastolic 76.7±7.3).

4.1.2. SOURCE OF THE SUBJECTS

Subjects were selected from residential *yoga* health home of the S-VYASA University, Bangalore, India.

4.1.3. INCLUSION CRITERIA

A. Patients with essential hypertension age from 30-70years.
B. Genders
C. Those with mild and/or moderate HTN
D. Diagnosed as primary/essential hypertension by excluding renal and other causes at the time of diagnosis by the family physician of the patient.,
E. Mild to moderate hypertension under control with antihypertensive medication,
F. Those with overweight/mild to moderate obesity (BMI≥35-40),
G. Those with no prior experience of *yoga*, and
H. Those willing to participate in the study.

4.1.4. EXCLUSIVE CRITERIA

A. Those with severe range of HTN
B. Patients with secondary hypertension such as Coractation of aorta, pheochromocytoma, steroid induced HTN etc.,
C. Patients with renal complications,
D. Those with associated diabetic complications,
E. Those with major associated diseases such as CAD,

F. Those on *āyurveda* medication for bowel clearance,

G. Those with severe obesity (BMI>40),

H. Those admitted to health home for < one week

4.1.5. INFORMED CONSENT

Informed consent was signed by all subjects of the study. For those who satisfied the selection criteria after admission, special class was organized, where the medical person in charge of the study explained the purpose and design of the study before obtaining the signature on the consent form.

4.1.6. EHICAL ISSUES

Institutional Ethical Committee clearance was obtained

4.2. METHODS:

All patients arrived between 9 am and 12 pm on Friday, which is a common admission day of the residential facility at the *ārogydhāma*. The patients from all parts of India would have made correspondences, discussed and chosen to register for the course before they arrive on Friday. They would have been introduced to the program by their friends (word of mouth) or the media.

After arrival, patients were allotted to different departments for holistic treatment after the basic clinical work-up by the medical team. The same day patients who fulfilled the inclusion criteria for the present study were selected, informed consent was obtained, and all assessments were documented. In the post lunch session an interactive presentation for all participants was organized to explain the schedule of the daily routine (5 am - 9 pm) during the course of next six days and clarify any doubts. Immediately after the general session, the researcher in charge took the group, which was recruited for the study to the annex room and explained the nature of the study and the procedure of LSP.

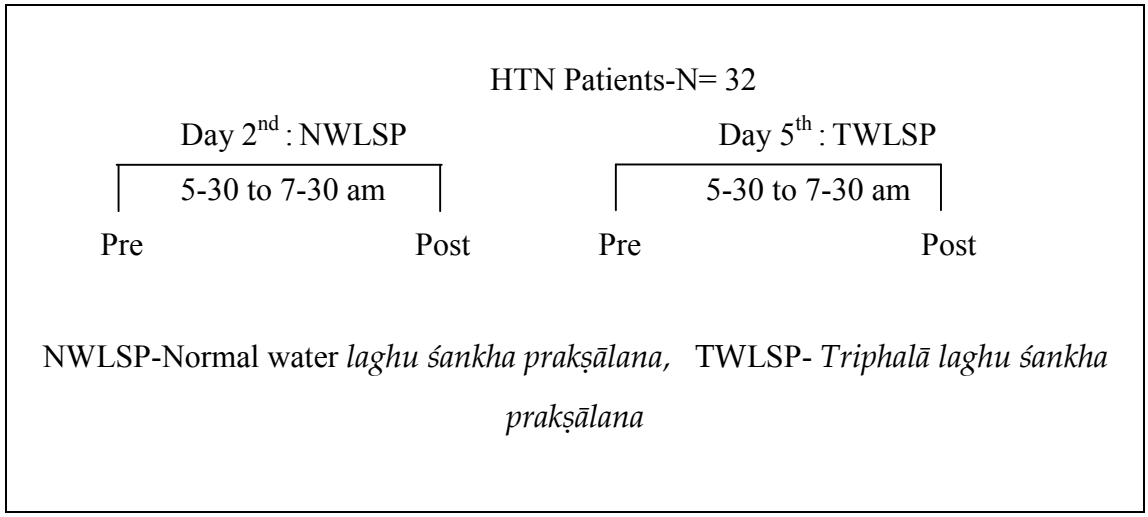
All the recruited patients practiced LSP with plain water on Saturday morning under close supervision. The experimental session took place on Thursday morning. Primary outcome measures were recorded by the researcher before and after both sessions in the same room where the deep relaxation session (phase 2 of the LSP) was conducted after returning from the active phase of LSP practice.

DESIGN:

Pre-post self as control

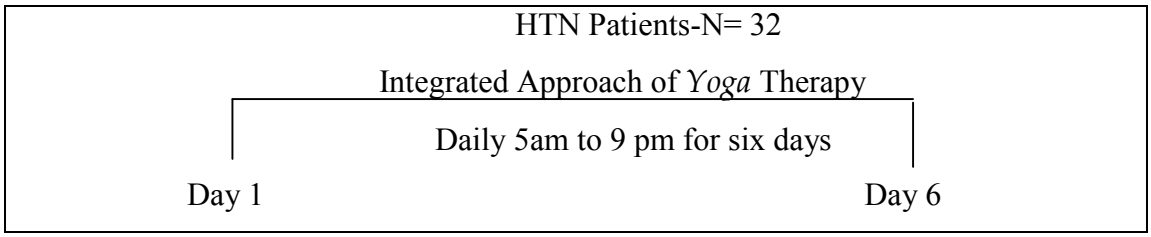
This was self as control design with four assessments i.e. pre-post assessments after two different sessions of practice in the same participant on the second and fifth day after admission.

4.2.1. :



Design for Primary objective

4.2.2.



Design for Secondary objective

4.3. INTERVENTION

4.3.1. Daily Schedule of Integrated Approach of Yoga Therapy

S. No	Time	Session
1	5.00-5.30am	Om meditation
2	5.30-6.30 am	*Yoga*-based special technique
3	6.30-7.30 am	Bath & wash
4	7.30-8.15 am	*Maitri Milan*-fraternity meet
5	8.15-8.45 am	Breakfast
6	8.45-10am	*Karma yoga*
7	10.00-10.30 am	Lecture (on *yogic* lifestyle)
8	10.30-11.00am	General parameters
9	11.00-12.00noon	*Prāṇāyāma*
10	12.00-1.00pm	*Yoga asanas*-special technique
11	1.00-2.00pm	Lunch break
12	2.00-2.30 pm	Deep Relaxation Technique (DRT)
13	2.30-4.00 pm	Assessments and counseling
14	4.00-5.00 pm	Cyclic meditation
15	5.00-6.15pm	Malt & Tuning to nature
16	6.15-6.45pm	*Bhajan* (devotional session)
17	6.45-7.45pm	Mind Sound Resonance Technique (MSRT)
18	7.45-8.30pm	Dinner
19	8.30-9.30 pm	Happy assembly
20	9.30-10.00pm	Self-study
21	10.00pm	Lights off

Table.4. Daily Schedule of Integrated Approach of *Yoga* Therapy

4.3.2. SCHEDULE OF LSP PRACTICE

SI NO	SCHEDULE	TIME
1	Assessments	5.30-6am
2	General preparations	6.15-6.20am
3	Drinking Luke warm water (3-4 glasses)	6.20-6.25am
4	Practices : *tāḍāsana* (palm tree pose), *tiryaka tāḍāsana* (swaying palm tree pose), *kaṭi cakrāsana* (waist rotating pose), *tiryaka bhujangāsana* (twisting cobra pose), *udarūkarśaṇa* (abdominal stretch pose)	6.25-6-45am
6	Evacuation of bowel	6.50- 7-05am
7	Deep Relaxation Technique in supine posture	7.05-7-30 am
8	Assessments	7.30-7.50am

Table.5. Showing *laghu śankhaprakṣālana* module

Vārisāra dhauti is more commonly know today as *laghu śankha prakṣālana*. During this practice we drink 3-4 glasses (200 ml) of warm water (*triphalā* water) and evacuate it through the bowels. First two glasses of water are drunk and above mentioned series of *āsanās* are performed.

After every two glasses of water the *āsanās* should be performed until the water starts flowing out of the anus. Once clear water starts coming through, and one feels that the stomach and intestines are perfectly clean, the practices can be stopped.

After 45 minutes or after deep relaxation technique (DRT), a saltless liquid mixture of cooked rice, mung dal and ghee has to be eaten until the stomach is completely full. There are dietary restrictions to observe for a week after this practice, and as it is a 'major operation', it must be done under the expert's guidance.

4.3.3. YOGA MODULE FOR HYPERTENSION:

SI.NO	NAMES	
1	*Ṣakti vikasaka sukṣma vyāyāma*	Loosening of fingers
		ānguli śakti vikāsaka
		Loosening of the wrist
		Elbow strengthening
		Shoulder rotation
		pādasancalana breathing
		Drill walking
2	Breathing practices	Hand stretch breathing
		Hand in and out breathing
		Ankle stretch breathing
		Tiger breathing
		Rabbit breathing
		Straight leg raise breathing
		setubandāsana breathing
		Side bending breathing
3	*Yogāsanas*	*ardakaṭi cakrāsana*
		rukṣāsana
		garuḍāsana
		bhujangāsana
		vakrāsana
		gomukhāsana
4	*Praṇayāma*	*naḍiśuddhi praṇayāma*
		vibhāgiya praṇayāma
		Bhahya & antara kumbaka
		sitalikara praṇayāmas
5	*Nadānusandhāna*	A- *kāra* chanting, 9 times
		U- *kāra* chanting, 9 times
		M- *kāra* chanting, 9 times
		A-U-M chanting, 9 times
6	*Ḍhyāna*	Cyclic meditation
		ॐ meditation
7	Relaxation techniques	IRT (Instance relaxation technique)
		QRT (Quick relaxation technique)
		DRT (Deep relaxation technique)

Table.5.*Yoga* Module for HTN

Practices:

LSP (*laghu śankhaprakṣālana*):

One day before all subjects were taught practical aspect of *laghu śankhaprakṣālana*.

Next day all parameters were recorded between 5.30 am and 6 am before going for LSP.

Again all parameters were recorded between 7.10 and 7.30 am immediately after the completion of emptying of their bowel followed by deep relaxation technique in *śavāsana* position.

4.4. ASSESSMENTS

Socio-demographic questionnaire:

A socio-demographic checklist was prepared for this study to document the following: Name, address, level of education, gender, age, presence of major diseases and medications taken if any.

4.4.1. PRIMARAY OUTCOME MEASURES

Blood pressure: Blood pressure was recorded by using electronic portable cardiac monitor equipment (BPL Company).

Digital cardiac monitor device:

Fig.2.

The phrase cardiac monitoring generally refers to continuous monitoring of the heart activity, generally by electrocardiography, with an assessment of the patient's condition relative to their cardiac rhythm. It is different from hemodynamic monitoring, which monitors the pressure and flow of blood within the circulatory system. The two may be performed simultaneously on critical heart patients. A small monitor worn by an ambulatory patient is known as a monitor. Transmitting data from a monitor to a distant monitoring station is known as a telemetry or a biotelemetry.

Pulse rate: Pulse rate recorded by electronic cardiac monitor

Respiratory rate: Manually recorded by counting the number of breaths/minute by the researcher while the attention of the patient was diverted.

No. of stools (Bowel): Total number of visits to empty the bowel after NWLSP or TWLSP reported by the participant was documented.

4.4.2. SECONDARY OUTCOME MEASURES

Weight: The weight was recorded using a standard electronic weighing scale.

Height: The height was assessed using standard scale- Stadiometer.

Body Mass Index (BMI): BMI was calculated using the following equation:

BMI= weight (kgs) /height (m^2)

Exhalation time or *Bhrāmari* Time (BHT):

Bhrāmari time was measured on the first and the last day by a using a stop watch. The average of the time taken (in seconds) for three rounds of chanting of *Bhrāmari* after deep inhalation was noted as BHT. This was considered a useful measure of slow vital capacity that is a useful monitoring technique, Which can be used in a clinical *yoga* therapy setting without the need for a spirometer. The chanting of long *Bhrāmari* helped in ensuring the accuracy of the practice and a mean of three attempts helped with recording the stability of the lung capacity.

Symptoms score:

Symptom score was calculated by using a symptoms checklist recorded during the semi structured clinical interview.

Medication score:

The number of anti-hypertensive tablets/day consumed by the participant on day one and on six was documented as a medication score. The standard strength of the tablet as given in the SIMS was checked as one tablet. For e.g. amlodipine 5mg was considered as one tablet; if it was on 2.5mg then it was counted as half a pill and if it was 10mg then it was recorded as 2 tablets. During the daily check ups by the doctors some changes would have been made in the dose when absolutely necessary.

Level of Fatigue:

The participants were asked to mark the degree of fatigue on a 11 point (1-10) numerical analogue scale of 10 centimeters with '0' at the left extreme indicating 'nil' fatigue and '10' at the extreme representing 'worst possible experience of fatigue,.

Level of Comfort:

The participants were asked to mark the degree of comfort on the 11 point (0-10) numerical analogue scale of 10 centimeters with '0' at the left extreme indicating 'nil' comfort and '10' at the right extreme representing 'most comfortable'.

PSYCHOLOGICAL QUESTIONNAIRES:

General Health Questionnaire (GHQ):

The GHQ designed by Goldberg is a self-administered questionnaire, which is used to identify psychiatric morbidity in general practice. It has 28 items with four subscales to measure somatic symptoms (SS), anxiety and insomnia (AI), social dysfunction (SF) and severe depression (SP).

It provides information about the recent mental status, thus, distinguishing the presence of possible psychiatric disturbance. This questionnaire has acceptable psychometric properties and has good internal consistency and reliability with Cronbach's alpha of 0.85 and validity of 0.76 (39).

STAI inventory (State Trait Anxiety Inventory):

STAI inventory is a commonly used psychological inventory based on a 4-point Likert scale and consists of 40 questions on a self-report basis. The STAI measures two types of anxiety-state, anxiety or immediate 'I feel now' and trait anxiety or anxiety level as a personal characteristic. Higher scores are positively correlated with higher level of anxiety.

It was developed by a psychologist, Charles Spielberger, R. L. Gorsuch (chrnbach's 0.6996 alpha and valid values 0.8027).

Quality of sleep:

A checklist containing the following questions was prepared for the participants to mark their quality of sleep on the previous night, starting with day 2 and 6.

1. Time taken to fall sleep: Measured in minutes
2. Total duration of sleep: Measured by analogue scale
3. Feeling of freshness in waking up: Measured by analogue scale
4. The number of interruptions: As reported by the participant on the day1 and the day 6 during the doctor's checkup recorded by using interruption check list.

4.5. DATA ANALYSIS:

The data was analyzed by using statistical package for the Social Science (SPSS Version20.0). Shapiro-Wilk's test was done for checking normality. Data of normally distributed variables (BP, Pulse, Respiratory rate, *Bhramari,* BMI, Comfort, STAI Anxiety level) were analyzed by using Paired samples *t* test ; data not normally distributed variables (Number of stools, GHQ, Medication and Symptom score, fatigue and quality of sleep) were analyzed by using Wilcoxon's signed rank test.

CHAPTER 5

5. RESULTS

5.1. STUDY PROFILE

Forty participants, who registered for integrated approach of *yoga* therapy (IAYT) in the cardiology departments of *ārogyadhāma* between 2012 and 2013 were screened. 32 participants who satisfied the selection criteria were included in the study and they all completed the program. There were no dropouts.

5.2. DEMOGRAPHIC DATA

1	Age	Mean ± SD		57.78±57.78
		Range	40-50	5
			51-60	15
			61-70	11
			>70	1
2	Gender	Males		14
		Females		18
3	Occupation	Employed		16
		Retired		03
		Housewives		13
4	Weight	Mean ± SD		70.34±13.68
5	Associated conditions	Diabetes		17
		Overweight		25
		Obesity		7
		Hyperlipidemia		11
		Sleep Apnea		2
		Others		Nil
6	Baseline Systolic BP	Mean ±SD (mm Hg)		137.25 ±16.39
	Baseline Diastolic BP	Mean ±SD (mm Hg)		86±9.47
7	Hypertensives	Mild (139/89)		21
		Moderate (159/99)		9
		Sever (>160/100)		Nil

Table.6. Demographic Data of Sample

5.3. RESULTS

5.3.1. IMMEDIATE EFFECT OF LSP

5.3.1.1. Blood pressure:

The baseline data were normally distributed. Paired sample test showed significant reduction in post systolic ($p<0.001$) & diastolic blood pressure ($p<0.001$) after both sessions.

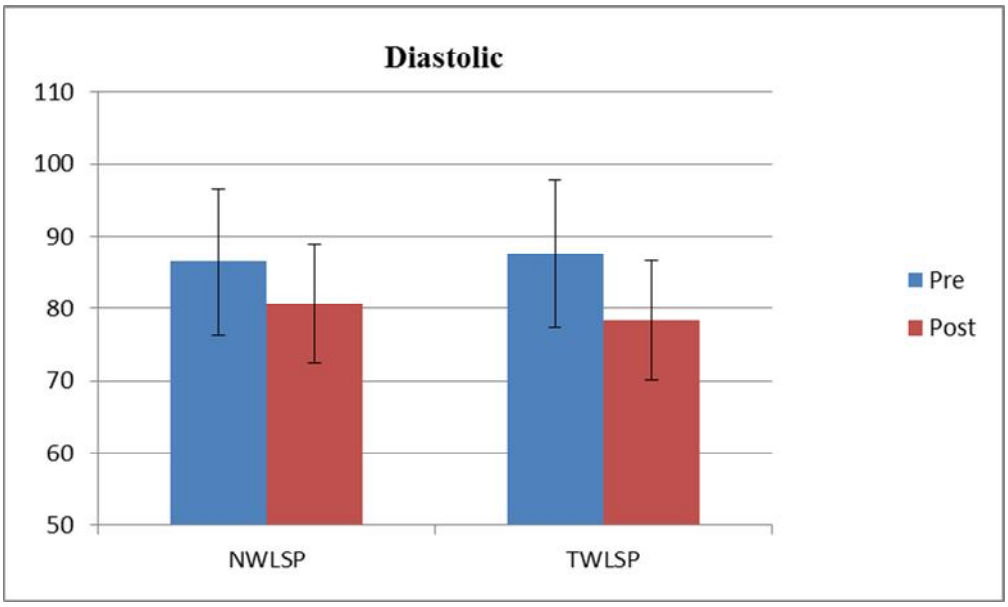
The post systolic blood pressure decreased by 6.8 % after NWLSP session and by 11.4% after TWLSP session; diastolic blood pressure decreased by 6.62 % after NWLSP session and by 10.4 % after TWLSP session with non-significant difference between the post values of the two sessions ($p<0.505$, Independent sample t test) Table.7, graph. 1and 2 Show the details.

Variable		NW LSP		% change	Sig* Within session p	TW LSP		% change	Sig* Within session p	Sig ** between sessions p
		Pre	Post			Pre	Post			
BP	Sys (Mm Hg)	137.25±16.3	127.81±12.8	6.88	0.001	141.8±19.2	125.5±13.9	11.4	0.001	0.505
	Dia (Mm Hg)	86.43±9.47	80.68±8.0	6.62	0.001	87.5±10.15	78.40±8.2	10.4	0.001	0.266

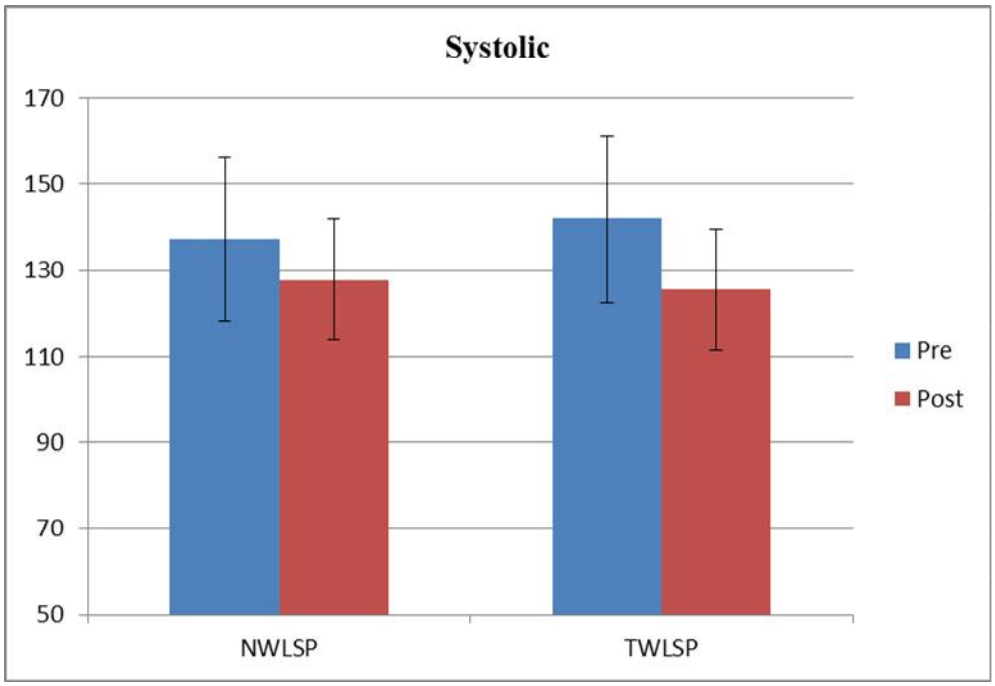
*Paired sample *t* test, **Independent sample *t* test,

Abbreviations: NWLSP -Normal water *laghu śankhaprakṣālana*, TWLSP-*triphalā* water *laghu śankhaprakṣālana.*

Table.7.BP summary



Graph.1. Diastolic blood pressure changes immediately after two sessions



*NW-Normal water, *TW- *Triphalā* water

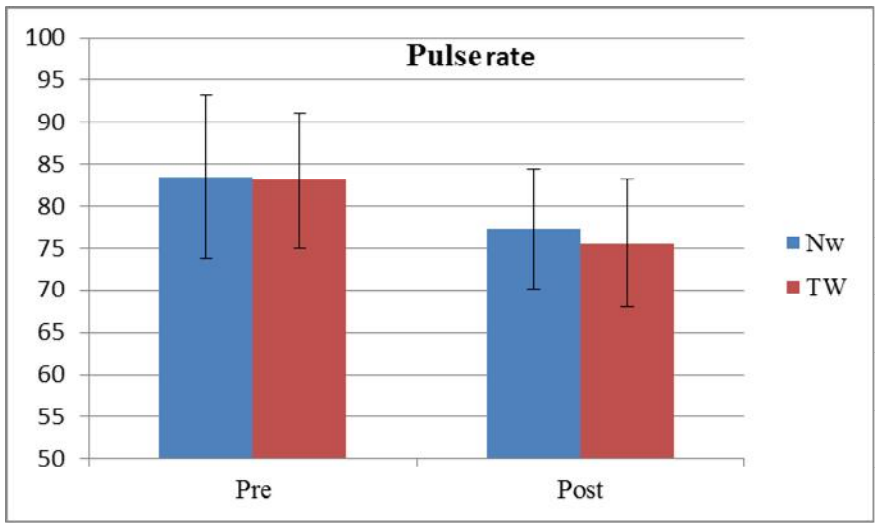
Graph.2. Systolic blood pressure changes immediately after two sessions

5.3.1.2. Pulse rate:

The baseline data were normally distributed. Paired sample tests showed significant reduction in post pulse rate in comparison to pre pulse rate in both groups ($p<0.001$). And there is no significant reduction between the group ($p< 0.847$, Independent sample *t* test) .7.4% of post pulse rate decreased in normal water group & 9.02% reduction in the *triphalā* group. Table.8, graph. 3 Show the details.

NWLSP		% change	Sig* p	TWLSP		% change	Sig* p	Sig between sessions
Pre	Post			Pre	Post			
83.5±9.83	77.28125±7.09	7.44	0.001	83.06±8.09	75.56±7.6	9.02	0.001	0.847

Table.8.Pulse rate summary



*NW-Normal water, *TW- *Triphalā* water

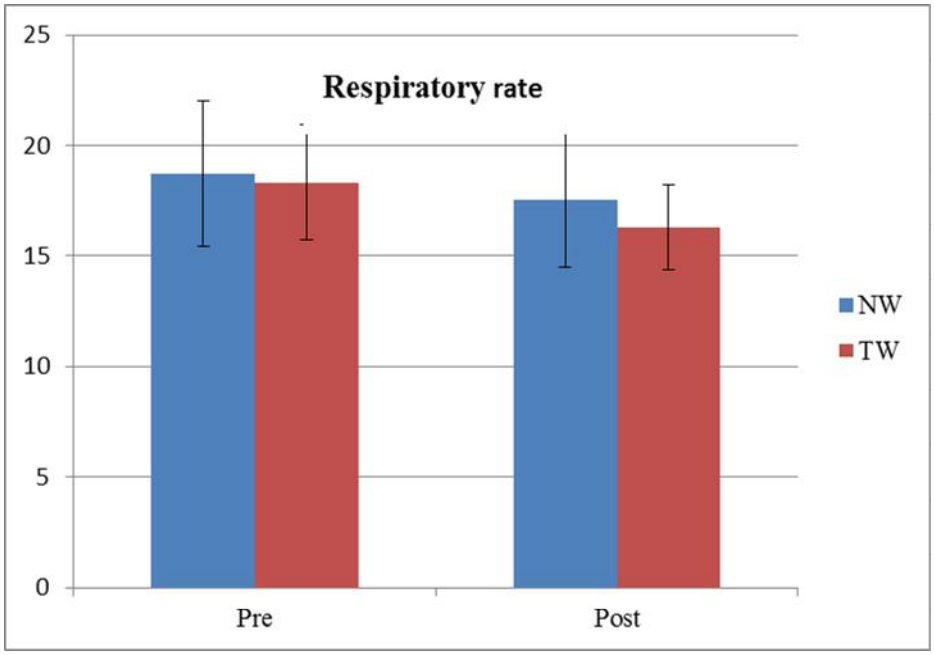
Graph.3. Pulse rate changes in both groups immediately after the intervention

5.3.1.3. Respiratory rate:

The baseline data were normally distributed. Paired sample test showed significant reduction in the post respiratory rate with respect to pre value in both groups ($p<0.001$) & there is no significant changes seen between the groups ($p>0.649$). Post normal water LSP shows 6.14 % changes & in *triphalā* group 11.03% changes seen. Table.9, graphs. 4 Show the details.

Variable	NW LSP		% change	Sig* p	TW LSP		% change	Sig* P	Sig between sessions
	Pre	Post			Pre	Post			
RR	18.71±3.29	17.56±3.05	6.14	0.001	18.3±2.6	16.28±1.92	11.03	0.001	0.649

Table.9. Respiratory rate summary



*NW-Normal water, *TW- *Triphalā* water

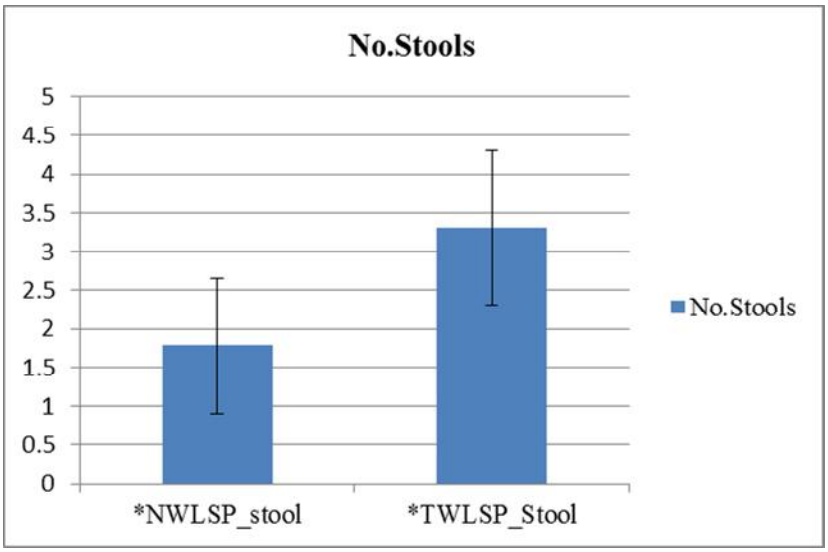
Graph.4. Significant decrease in post RR in both groups

5.3.1.4. Number of stools:

The baseline data were not normally distributed. Wilcoxon Signed Rank test showed a significant increase in the number of stools ($p<0.001$) in Trp. LSP comparing to normal water LSP. 85.39% of stool (bowels) increased by Trp. LSP. Table.10, graph. 4 Show the details.

Variable	NW LSP		TW LSP		% change	Sig* p	Sig between sessions
	Pre	Post	Pre	Post			
No. Stools		1.78±0.87		3.3±1.00	-85.39	0.001	0.001

Table.10. Number of time Bowels



*NW-Normal water, *TW- *Triphalā* water, LSP - *laghuśankhaprakṣāśalana*

Graph.5. Showing significant increase in the number of bowel in *triphalā LSP* group

5.3.2. CHANGES AFTER WEEKLONG IAYT

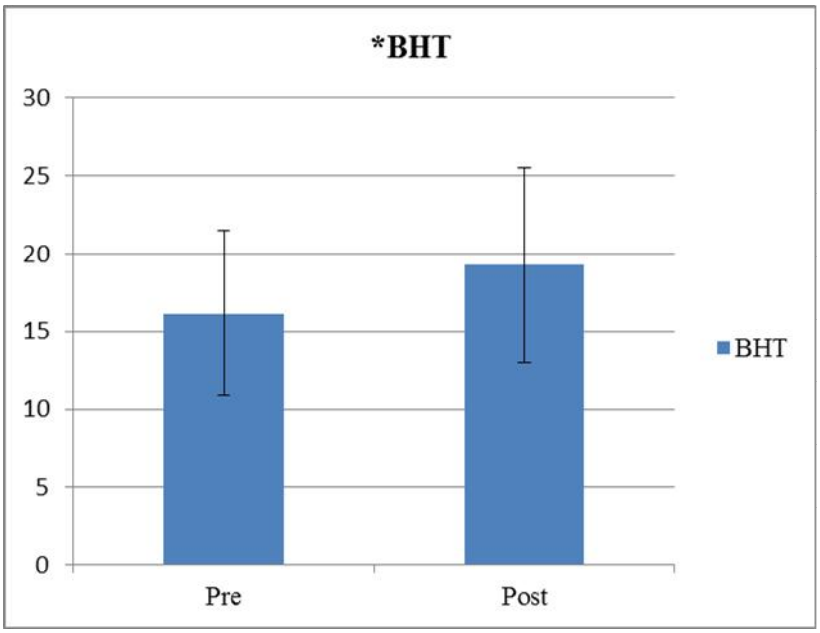
Common biometric parameters were recorded on the 1st & last day of one week IAYT therapy in the intervention group (normal water LSP & TW group LSP).

5.3.2.1. *Bhrāmari* time:

The baseline data were normally distributed. Paired sample test showed a significant increase in *bhrāmari* time ($p<0.001$) increased by 18.97% after weeklong intervention. Table.11, graph. 6 Show the details.

Variable	Pre	Post	% change	Sig* p
BHT (Sec)	16.18±5.30	19.25±6.27	-18.97	0.001

Table.11.Breath Holding Time



*BHT- *Bhrāmari* time

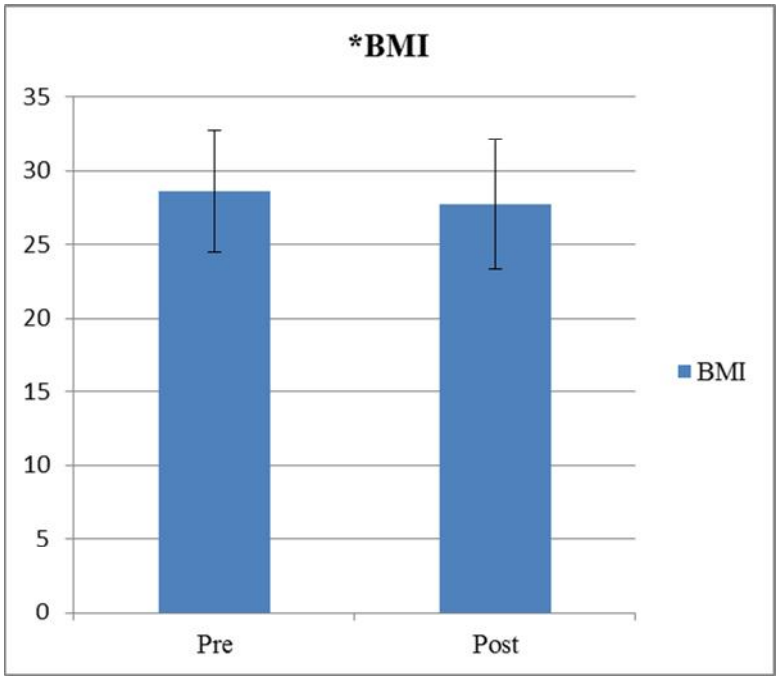
Graph.6. *Bhrāmari* time

5.3.2.2. BMI:

The baseline data were normally distributed. Paired sample test showed significant reduction in weight ($p<0.004$) & 3.14% changes seen after one week IAYT therapy in the intervention group. Table.12, graph. 7 Show the details.

Variable	Pre	Post	% change	Sig* p
BMI (kg)	28.63±4.14	27.73±4.40	3.14	0.004

Table.12. Body Mass Index (BMI) Summary



*BMI-Body mass index

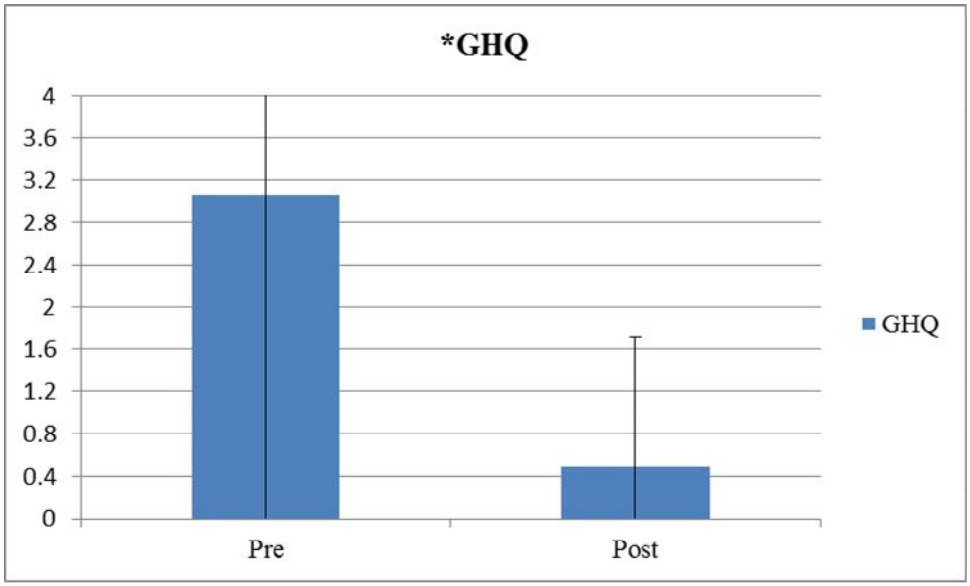
Graph.7. BMI

5.3.2.3. GHQ (General health questionnaire):

The baseline data were not normally distributed. Wilcoxon Signed Rank Test showed significant increase of the quality of life (General Health) (P<0.001) & 83.66% change seen after one week IAYT therapy in the intervention group. Table.13, graph. 8 Show the details.

Variables	Pre	Post	% change	Sig* p
GHQ	3.06±4.62	0.5±1.21	83.66	0.001

Table.13.GHQ Summary



* GHQ-General Health Questionnaire

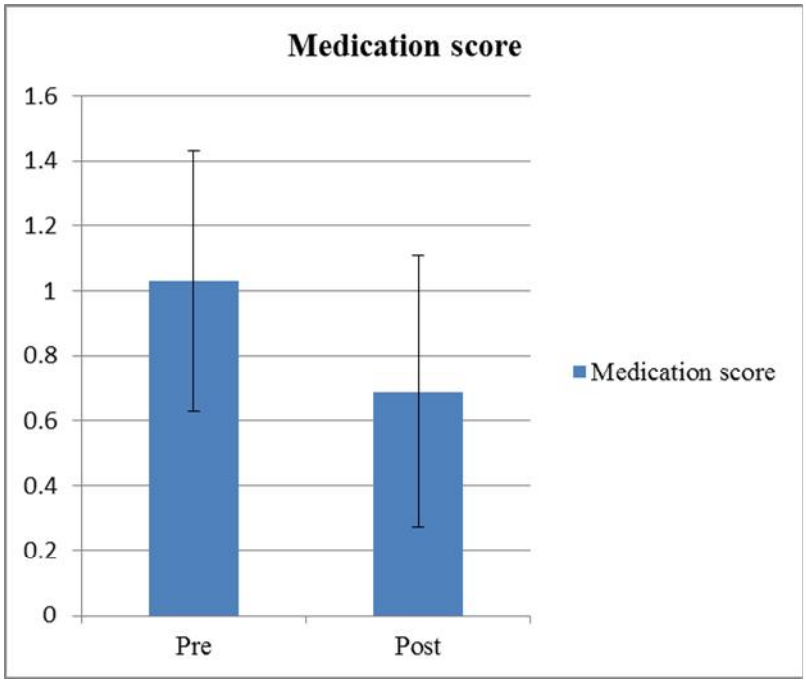
Graph.8.General Health problems

5.3.2.4. Medication score:

The baseline data were not normally distributed. Wilcoxon Rank Test showed significant decrease in anti-hypertension medications (P<0.001) & 33.98% change seen after one week IAYT therapy in the intervention group. Table.14, graph. 9 Show the details.

Variable	Pre	Post	% change	Sig* p
Medication score	1.0312±0.40	0.6875±0.418	33.98	0.001

Table.14.Summary of Medication Score



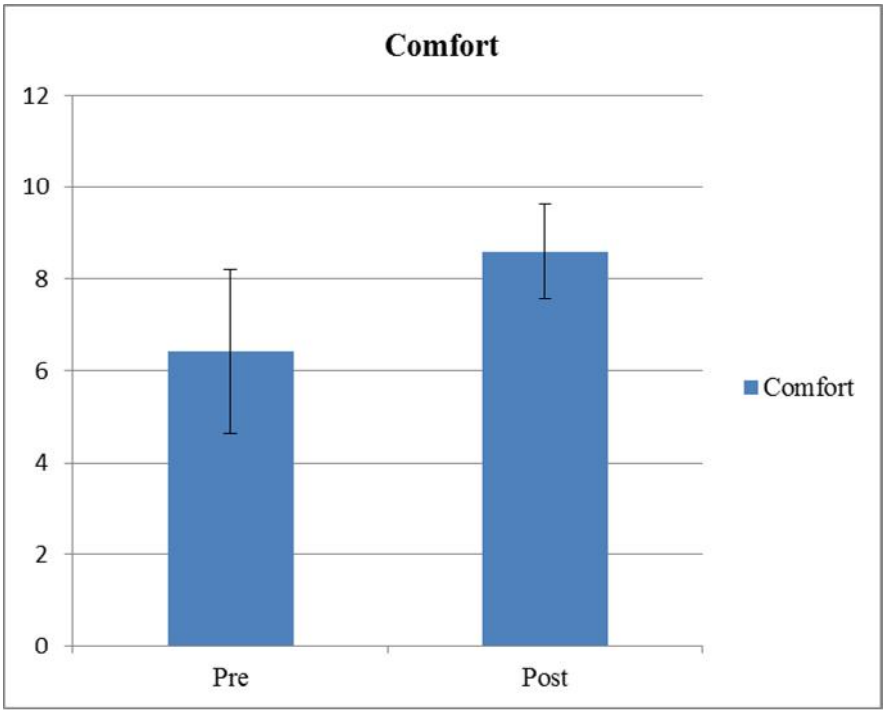
Graph.9. Medication

5.3.2.5. Level of Comfort:

The baseline data were normally distributed. The paired sample test showed a significant increase in comfort ($p<0.001$) & 33.59% of comfort increased after one week IAYT therapy in the intervention group. Table.15, graph. 10 Show the details.

Variable	Pre	Post	% change	Sig* p
Comfort	6.43±1.79	8.59±1.04	-33.59	0.001

Table.15. Level of Comfort



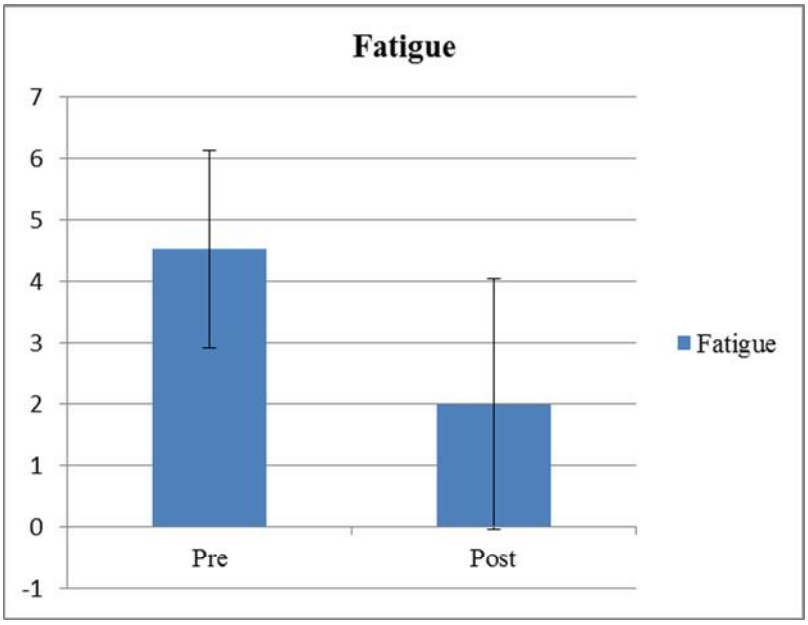
Graph.10. Level of comfort

5.3.2.6. Level of Fatigue:

The baselines were not normally distributed. Wilcoxon Rank Test showed significant alleviation in fatigue (P<0.000) & 55.84% change seen after one week IAYT therapy in the intervention group. Table.16, graph. 11 Show the details.

Variable	Pre	Post	% change	Sig* p
Fatigue	4.53±1.60	2±2.04	55.84	0.001

Table.16. Fatigue



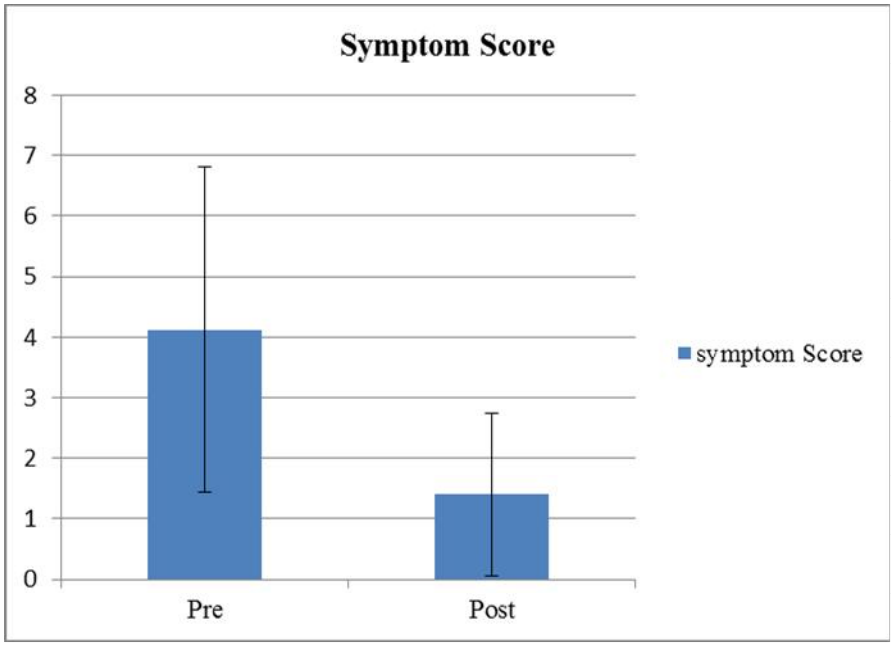
Graph.11. Level of fatigue

5.3.2.7. Symptoms score:

The baseline data were not normally distributed. Wilcoxon Rank Test showed significant alleviation of symptoms (P<0.001) & 66.01 % change seen after one week IAYT therapy in the intervention group. Table.17, graph. 12 Show the details.

Variable	Pre	Post	% change	Sig* p
Symptom Score	4.12±2.69	1.40±1.34	66.01	0.001

Table.17. Symptoms Score



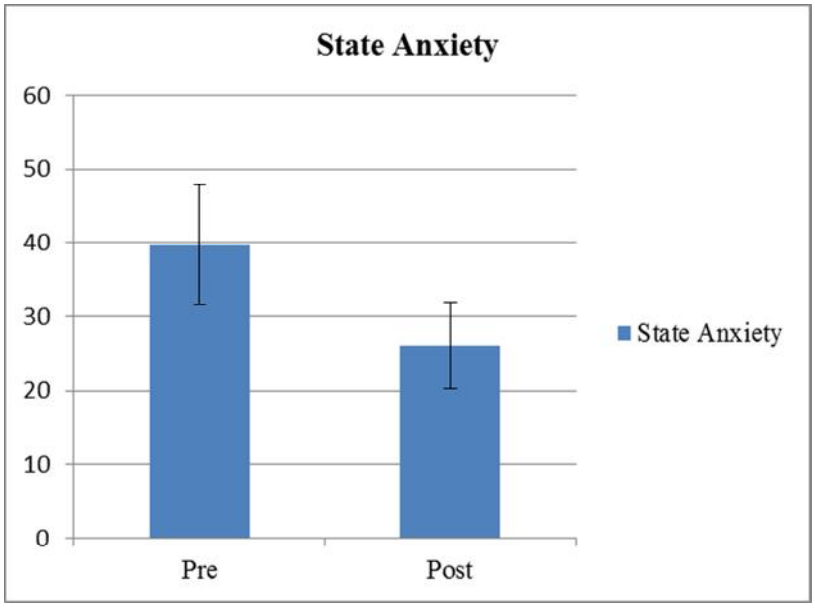
Graph.12. Showing significant decrease in post symptom score

5.3.2.8. State anxiety:

The baseline data were normally distributed. Paired sample test showed significant state anxiety ($p<0.001$) & 34.32% of state anxiety alleviatione after one week IATY therapy in the intervention group. Table.18, graph. 13 Show the details.

Variable	Pre	Post	% change	Sig* p
State Anxiety	39.68±8.16	26.06±5.82	34.32	0.001

Table.18.Summary of Sate Anxiety



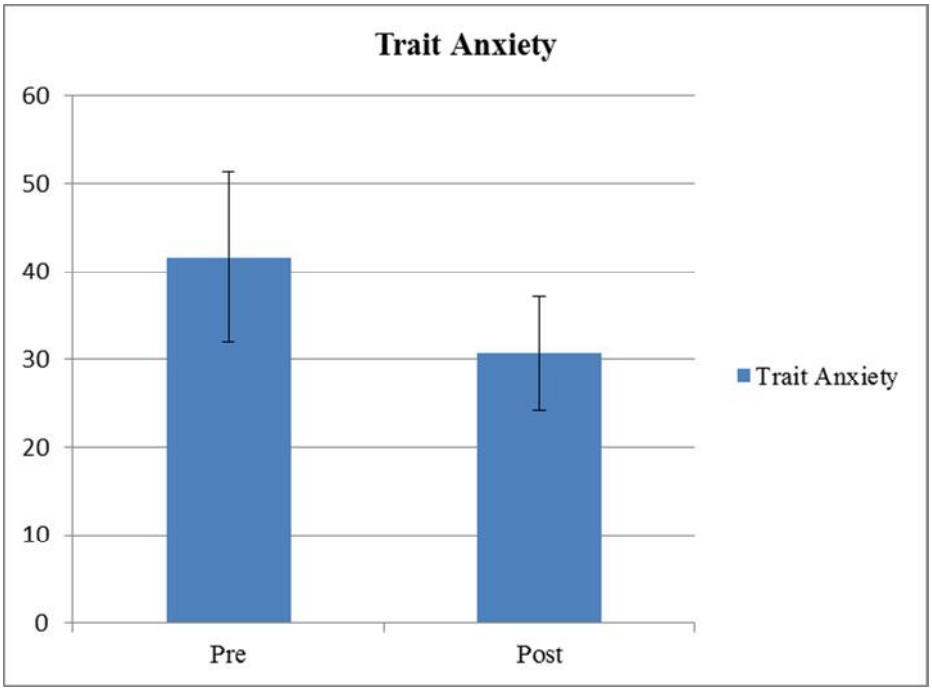
Graph.13.State Anxiety

5.3.2.9. Trait anxiety:

The baseline data were normally distributed. Paired sample test showed significant reduction in the trait anxiety ($p<0.001$) & 26.16% of trait anxiety alleviate after one week IATY therapy in the intervention group. Table.19, graph. 14 Show the details.

Variable	Pre	Post	% change	Sig* p
Trait Anxiety	41.59±9.70	30.71±6.46	26.16	0.001

Table.19.Summary of Trait Anxiety



Graph.14. Trait anxiety

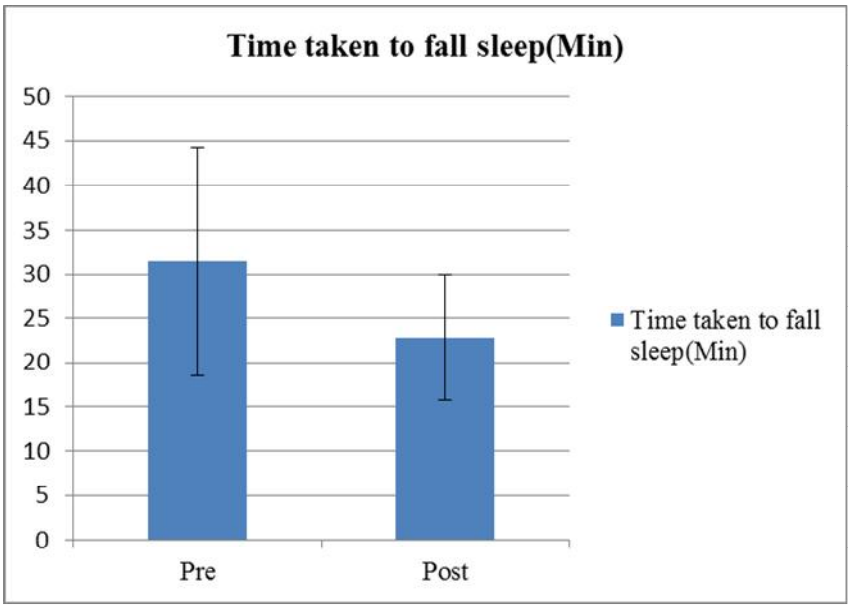
5.3.2.10. Quality of sleep:

1) Time taken to fall sleep:

The baseline data were not normally distributed. Wilcoxon Rank Test showed significant decrease in time taken to fall sleep ($p<0.001$) & 27.35% reduction in time. Table.20, graph. 15 Show the details.

Sleep	Pre	Post	% change	Sig* p
Time taken to fall sleep (Min)	31.40±12.90	22.81±7.06	27.35	0.001

Table.20.Time taken to fall sleep



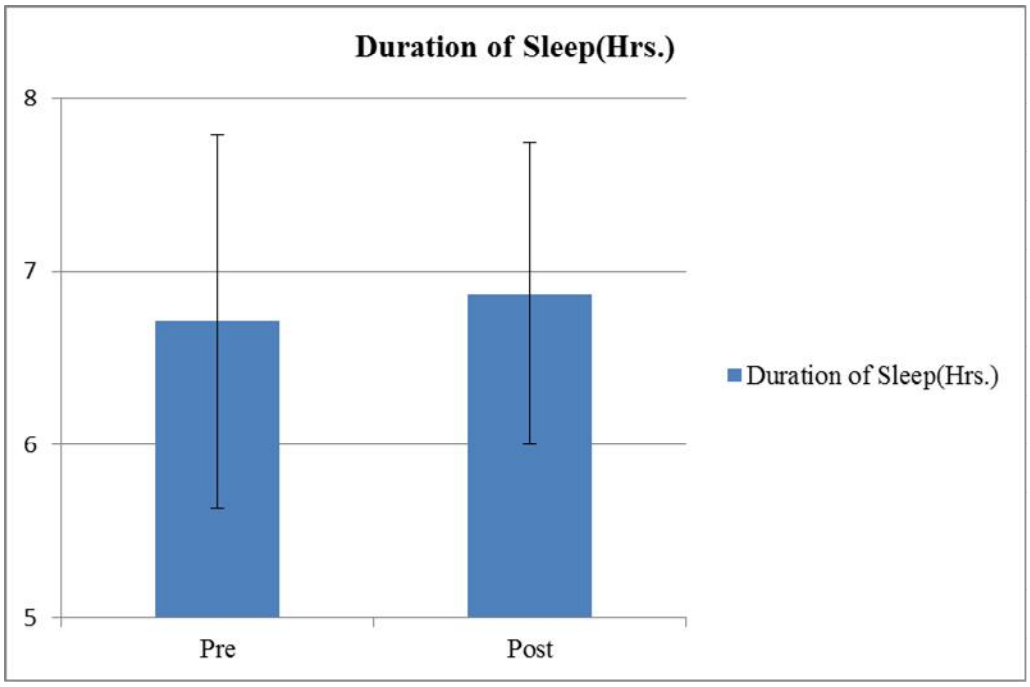
Graph.15. Showing significant decrease in time taken to fall sleep

2) Duration of sleep:

The baseline data were not normally distributed. Wilcoxon Signed Rank test showed that there is no significant changes in the duration of sleep (p>0.503) & 1.3% of changes seen in duration. Table.21, graph. 16 Show the details.

Sleep	Pre	Post	% change	Sig* p
Duration of Sleep (Hrs.) /night	6.71±1.08	6.87±0.87	-2.38	0.503

Table.21.Duration of sleep



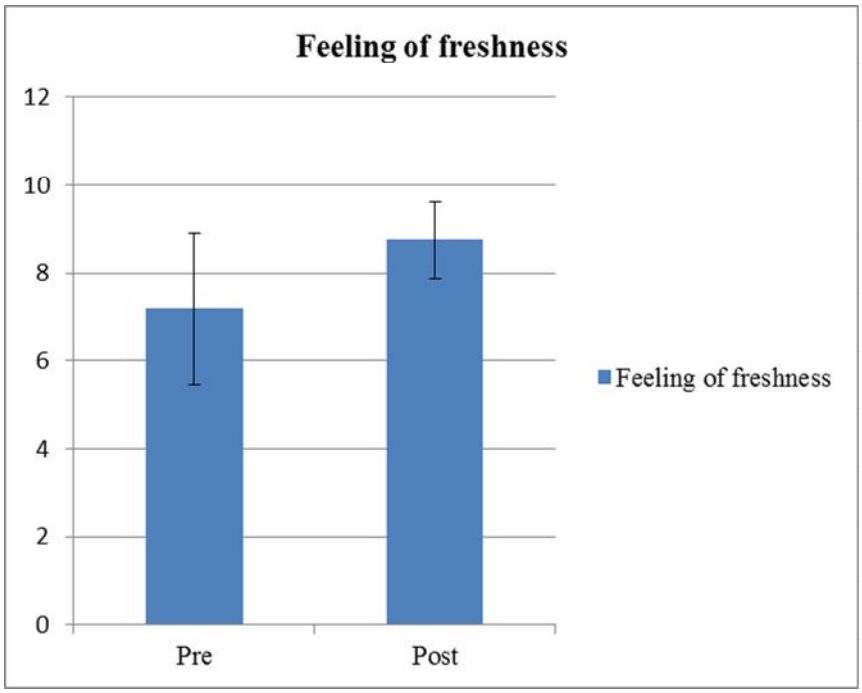
Graph.16. Showing significant decrease in duration of sleep

3) Feeling of freshness after waking up:

The baseline data were not normally distributed. Wilcoxon Signed Rank Test showed significant increase in feeling of freshness ($p<0.001$) & 21.86% of feeling of freshness increased. Table.22, graph. 17 Show the details.

Sleep	Pre	Post	% change	Sig* p
Feeling of freshness on waking	7.18±1.74	8.75±0.87	-21.86	0.001

Table.22.Feeling of freshness after waking up



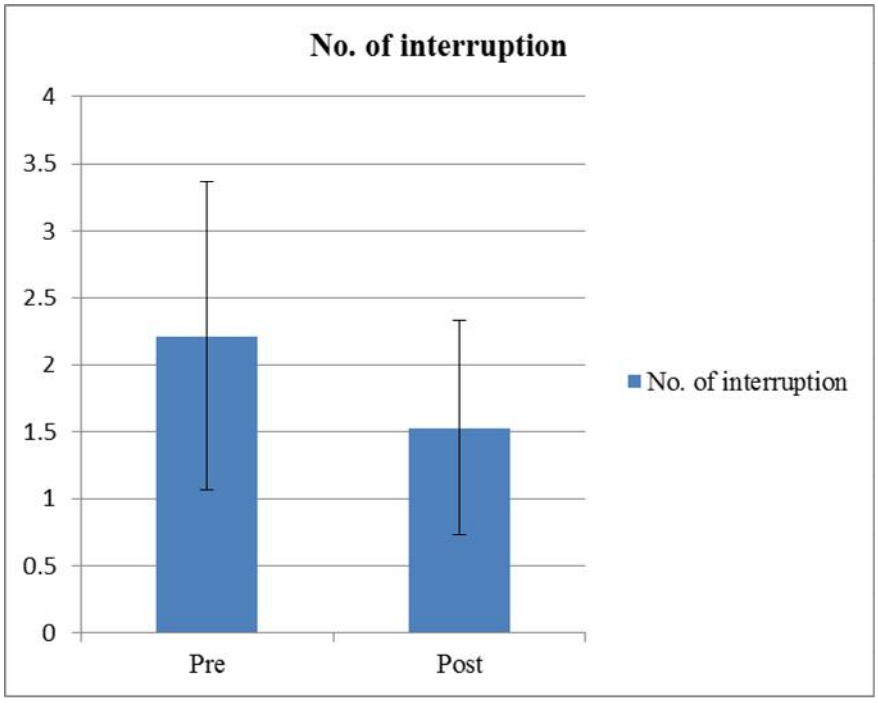
Graph.17. Showing significant increase after feeling of freshness

4) Number of interruptions:

The baseline data were not normally distributed. Wilcoxon Signed Rank Test showed significant decrease in the number of sleep interruption ($p<0.001$) & 30.76 % of interruptions decreased. Table.23, graph. 18 Show the details.

Sleep	Pre	Post	% change	Sig* p
Number of interruptions	2.21±1.15	1.53±0.80	30.76	0.001

Table.23.Number of interruptions during the night sleep



Graph.18. Showing significant decrease in total No. of interruptions

CHAPTER 6

6. DISCUSSION

6.1. THIS STUDY

This self as control pre-post study of 32 participants with essential hypertension was conducted at the residential campus of S-VYASA University. It assessed the immediate effect of NWLSP and TWLSP on blood pressure in participants of mild to moderate primary hypertension. There was significant reduction in systolic blood pressure ($p<0.001$), diastolic blood pressure ($p<0.001$), Respiratory rate ($p<0.001$) and Pulse rate ($p<0.001$) immediately after both sessions. TWLSP offered better ($p<0.001$) bowel clearance than NWLSP as seen by the total number of stools passed immediately after the practice.

Significant changes were also observed in a comprehensive battery of tests used after a week lasting program of residential IAYT. There was significant reduction in BMI ($p<0.004$), fatigue ($p<0.001$), medication score ($p<0.001$), general health problems (GHQ) ($p<0.001$), symptoms score ($P<0.001$), and the scores of state and anxiety (STAI) ($P<0.001$); there was also significant increase in exhalation time (*bhrāmari* time) ($p<0.001$), comfort level and quality of sleep.

6.2. COMPARISON WITH EARLIER STUDIES

This is the first study that has looked at the effect of adding *yogic* LSP to a multimodal program of *yoga*, a non-pharmacological mind body intervention, in patients with moderate to mild HTN. We shall compare the results of earlier studies that have used other yoga practices in different settings and different combinations on patients with hypertension within and outside India.

6.2.1. Prāṇāyāma for Hypertension:

Telles et al (2013) [94] conducted a randomized control study on 90 (group average age ±S. D. 49.7±9.5 years; 60 males) participants with essential hypertension to assess the immediate effect of alternate nostril *yoga* breathing. The participants were randomly divided into three groups with thirty participants in each group. Group 1 practiced

alternate nostril *yoga* breathing for 10 minutes; Group 2 practiced breath awareness for the same duration; and Group 3 was given a control intervention (i.e., reading a magazine with neutral content). The study found that there was a significant decrease in systolic and diastolic blood pressure ($p<0.001$ and $p<0.05$) immediately after Alternate nostril breathing (ANYB), whereas breath awareness (the control session) showed a significant reduction in systolic blood pressure ($p<0.05$) only as compared to the control. They observed a reduction of systolic blood pressure by 4.24% and diastolic blood pressure by 1.56% respectively, immediately after 10 minutes of ANYB and in our study 11.4% and 10.4% in TWLSP and in NWLSP group 6.68% and 6.62% change in systolic and diastolic blood pressure respectively.

A study was undertaken to determine the immediate effects of *sukha prāṇāyāma* on cardiovascular variables in hypertensive patients. Twenty three hypertensive patients attending *Yoga* OPD at JIPMER were recruited for the study and instructed to perform *sukha prāṇāyāma* for 5 minutes at the rate of 6 breaths/min. This *prāṇāyāma* involves conscious, slow and deep breathing with equal duration for inhalation and exhalation. Heart rate (HR) and BP were recorded before and immediately after the intervention. Post-intervention statistical analysis revealed a significant ($p < 0.05$) reduction in HR and a highly significant ($p < 0.001$) reduction in systolic pressure, pulse pressure, mean arterial pressure, rate-pressure product, and double product with an insignificant fall in diastolic pressure[95].

In another study twenty-two (22) postmenopausal women with prehypertension were randomly assigned to either the experimental group or the control group. The experiment group performed 10 sessions of slow abdominal breathing (six cycles/min) combined with frontal electromyographic (EMG) biofeedback training and daily home practice, while the control group only performed slow abdominal breathing and daily home practice. BP and HRV (including R-R interval and standard deviation of the normal-normal intervals [SDNN]) were evaluated. Participants with prehypertension could reduce their systolic blood pressure (SBP) by 8.4 % ($p<0.001$) and diastolic blood pressure (DBP) by 3.9 % ($p<0.05$) using slow abdominal breathing combined with EMG

biofeedback. The slow abdominal breathing also significantly decreased the SBP by 4.3 % ($p < 0.05$), while it had no effect on the DBP ($p > 0.05$). Repeated-measures analyses showed that the biofeedback group + abdominal respiratory group (AB+BF) training was more effective in lowering the BP than the slow breathing ($p < 0.05$)[96].

6.2.2. Hatha yoga and Hypertension:

The study conducted by Miles et al (2013) measured changes in systolic and diastolic BP on both novice (n = 19) and advanced *yoga* practitioners (n = 18) after 8 months of intervention that consisted of a series of 23 *Hatha*-based *yoga* postures that included standing, sitting, supine and prone postures. The study showed that Systolic, mean, and diastolic blood pressures increased significantly ($p<0.05$) after *yoga* practice recorded by electronic sphygmomanometer. The magnitude of these increases in blood pressure was great with standing postures. Heart rate and cardiac output increased significantly ($p<0.05$) during *yoga* practice, especially with standing postures[97].

Study by Zhang et al measured effect of traditional Chinese physical and mental exercises on the blood pressure of twenty adult female (age 50-60years) hypertensive patients, who voluntarily participated in the study. The participants performed the combined exercises for 24 weeks, twice a week, and 60 min each time in low-to-moderate intensity. After the 24-week training, the participants showed significant decreases in systolic blood pressure ($p<0.000$), diastolic blood pressure ($p< 0.006$) and pulse rate ($p< 0.001$)[98].

The two group pre-post, randomized control study of Mizuno (2013) observed the effects of a *yogāsana* sequence on hemodynamic parameters in patients with essential hypertension. The sample size was 33 (control=16 and *yoga*=17) and four month intervention was given. Blood pressure measurements, cardiac and respiratory rate were recorded monthly at the beginning and the end of the program. In the end of the program, the *yoga* group showed a significant reduction of systolic blood pressure ($p < 0.05$), heart and respiratory rate ($p < 0.05$)[99].

6.2.3. Meditation and Hypertension:

This study conducted by Priya P, Page G, Piferi R, Gill M, Hayat J, et al. On Mindfulness-based stress reduction (MBSR). Twenty participants (Age mean=65. 7yrs, Male=1) were randomized to the mindfulness-based intervention or a social support control group of the same duration and dose. Blood pressure was measured by the Omron automatic blood pressure machine at baseline and at the end of the 8-week intervention. A multivariate regression analysis was performed on the difference in scores between baseline and post-intervention blood pressure measurements, controlling for age, education, smoking status, and anti-hypertensive medication use. Effect sizes were calculated to quantify the magnitude of the relationship between participation in the mindfulness-based intervention, the outcome variable and blood pressure. Attendance remained 98% in all 8weeks of both the intervention and the control groups. The average systolic blood pressure decreased in both groups post-intervention. Individuals in the intervention group exhibited a 21.92-mmHg lower systolic blood pressure compared to the social support control group post-intervention and this value was statistically significant ($p<0.020$). The average diastolic blood pressure decreased in the intervention group post-intervention, but increased in the social support group. Individuals in the intervention group exhibited a 16.70-mmHg lower diastolic blood pressure compared to the social support group post-intervention, and this value was statistically significant ($p<0.003$). Older adults are at a time in life when a reflective, stationary intervention, delivered in residence, could be an appealing mechanism to improve blood pressure[53].

6.2.4. Transcendental Meditation (TM):

This was a randomized controlled trial (RCT) of 298 university students randomly allocated to either the Transcendental Meditation (TM) program or wait-list control. At baseline and after 3 months, BP, psychological distress, and coping ability were assessed. A subgroup of 159 subjects at risk for hypertension was analyzed similarly. Changes in systolic BP (SBP) /diastolic BP (DBP) for the overall sample were −2. 0/−1. 2 mm Hg for the TM group compared to +0.4/+0.5 mm Hg for controls (P= 0.15, P=0. 15, respectively). Changes in SBP/DBP for the hypertension risk subgroup were −5. 0/−2. 8 mm Hg for the TM group compared to +1.3/+1.2 mm Hg for controls (P= 0.014, P=

0.028, respectively). Significant improvements were found in total psychological distress, anxiety, depression, anger/hostility, and coping (P values< 0.05). Changes in psychological distress and coping correlated with changes in SBP (P values< 0.05) and DBP (P values< 0.08)[100].

The study of Schneider et al. (2012) was a randomized, controlled trial of 201 black men and women with essential hypertension associated with coronary heart disease that were randomized to the TM program or health education. The primary end points (all-cause of mortality, myocardial infarction or stroke), secondary end points (blood pressure, stress cardiovascular mortality and cardiovascular hospitalizations), during an average follow-up of 5.4 years, there was a 48% risk reduction in the primary end point in the TM group (hazard ratio, 0.52; 95% confidence interval, 0.29-0.92; *P*<0. 025). The TM group also showed a 24% risk reduction in the secondary end point (hazard ratio, 0.76; 95% confidence interval, 0.51-0.1.13; *P*<0. 17). There were reductions of 4.9 mm Hg in systolic blood pressure (95% confidence interval -8.3 to -1.5 mm Hg; *P*=0. 01)[101].

Chandra Patel study on twenty hypertensive patients treated by *yogic* way of psychophysical relaxation exercises were followed up monthly for 12 months. Age and sex matched hypertensive controls were similarly followed up for 9 months. Statistically significant *(P*<0. 01*)* Reductions in blood-pressure (B.P.) and antihypertensive drug requirements were satisfactorily maintained in the treatment group. Mere repetition of B.P. Measurements and increased medical attention did not reduce B.P. significantly in control patients[102].

Another study was done by Palomba et al on effect of a short Heart Rate-Biofeedback (HR-BF) protocol on systolic (SBP) and diastolic (DBP) blood pressure levels and BP emotional reactivity. Twenty-four unmedicated outpatients with pre- and stage 1 hypertension, were randomly assigned to active treatment (BF-Training) or control (BP-Monitoring) group. Subjects in BF-Training Group underwent four BF sessions. Guided imagery of stressful events was introduced during sessions 3 and 4. Control participants' self-monitored their BP at home for 4 weeks. Subjects in both groups performed an

emotional Speech Test before and after the training (or monitoring) period. SBP and mean arterial pressure responses to the emotional Speech Test were significantly smaller after the BF-training than at the time of the BP-monitoring. Moreover, clinic SBP and DBP were significantly reduced by about 10 mm Hg in BF-Training Group, whereas they remained unchanged in control groups[103].

Study of Chandra et al on employees of a large industry were screened for the presence of coronary risk factor. A total of 204 employees, aged 35-64 years, with two or more such factors (Serum cholesterol concentration >6.3 mmol/l (243.6 mg/100ml), blood pressure >140/90mm Hg, and current cigarette consumption >10 cigarettes a day) receiving training in relaxation and management of stress or a control group. Both groups received a simple health education literature. After eight weeks of training, and again eight months later, the biofeedback group showed a significant decrease in systolic and diastolic blood pressure than the control group ($p<0.001$). Plasma renin activity and plasma aldosterone concentration were measured in a subsample at entry to the study and again at eight weeks and eight months; both showed a greater reduction in the biofeedback compared with the control group at eight week's follow-up.

The greater reduction in blood pressure in the subjects in the biofeedback group compared with the control group (11.0mm Hg systolic and 8.8mm Hg diastolic), persisting eight months after the training, suggests that relaxation-based behavioral methods might be offered as a first-line treatment to patients with mild hypertension[104].

The Montfrans et al study of long term effects of relaxation therapy on 24 hour ambulatory intra-arterial blood pressure in patients with mild un-treated and uncomplicated hypertension (35 Subjects aged 20-60), four week screening period followed by randomization to receive either relaxation therapy or non-specific counseling for one year. Ambulatory intra-arterial blood pressure was measured before and after treatment. Subjects were being treated by general practitioners for hypertension but were referred to take part in the study. In three consecutive screening visits all subjects had a diastolic blood pressure without treatment of 95-110mm Hg. 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 groups 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.

Mean urinary sodium excretion, serum concentration of cholesterol, and body weight did not change in either group. Diastolic pressures measured by sphygmomanometer were 2 and 3 mmHg lower in subjects in the relaxation group and control group respectively in 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 in 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 group's nighttime pressure was 5 mm Hg higher. The variability in blood pressure was the same at both measurements[105].

Thus, we observe that different kinds of meditations cause reductions in systolic and diastolic BP in a different way and the effect also depends on the interval for which the meditation is given. For e.g., Biofeedback studies reduced systolic BP by 19.6% and diastolic BP by 10.6 % at the end of 8 weeks of meditation, which further reduced by 22.4% and 11.5% at the end of 8 months respectively. This is a maximum reduction noted in BP variables by any mind-body intervention. Another highly effective mind-body technique is MBSR, which caused a reduction of 21.92% in systolic BP and 16.70% in diastolic BP after 8 weeks of the practice. Thus, at the end of 8 weeks MBSR appears even more effective than biofeedback. Other meditations such as Transcendental meditation, *yogic* relaxation, Om meditation etc. caused a reduction in Systolic BP ranging from 2 to 10 % and in diastolic BP from 1.5 to 13 %.

In the present study, we find that after TWLSP systolic BP showed reduction by 11.4% and diastolic BP reduced by 10.4%, whereas NWLSP caused systolic and diastolic BP to come down by 6.88 and 6.62 % respectively. Thus, we find that LSP practices are more effective than breathing practices such as ANYB, Breath Awareness, or abdominal breathing and meditations such as *yogic* relaxation and transcendental meditation, but less effective than the techniques of Biofeedback and MBSR. Among LSP practices also

TWLSP appears to be more effective than NWLSP. The reason behind the above differences in results may be because of the intensity of the intervention and the extent of parasympathetic dominance an intervention brings. LSP practices may have brought a state of greater parasympathetic dominance as compared to breathing practices or some meditations. It would be interesting to see and compare the effects of these interventions on the autonomic variables, such as heart rate variability in future studies. Also, future studies should see whether these interventions act synergistically with each other to cause a still greater reduction in BP if they are combined together, for. E.g., if the patient performs 10 min of ANYB and biofeedback or MBSR immediately after LSP, will there be a greater fall in BP as compared to either of them? Future studies should look into the application of these non-pharmacological interventions more intensively and see whether these simple and safe interventions could replace or enhance the efficacy of modern anti-hypertensives.

Name of study		% Change (mm Hg)		Duration
		Systolic	Diastolic	Pre-Post intervention
Present study	TWLSP	-11.4	-10.4	60 min
	NWLSP	-6.88	-6.62	
Biofeedback (Wang SZ, Li S, Xu XY,)	Biofeedback group + abdominal respiratory group (AB+BF)	-8.4	-3.9	60 min
	Abdominal respiratory group	-4.3	No change	
Biofeedback (Chandra P, Marmot M,)	8 (n=50) weeks	-19.6	-10.6	60 min
	8 (n=48) months	-22.4	-11.5	
Syllable chanting I.e Om and MOM (Telles S, Nagarathna R)		-7.21	-13.15	30 min
Kaphālabhati (Stancák A Jr, Kuna M)		+ 15	+ 6	5 min
Alternate nostril breathing (Tells S, Yadav A, Kumar N,)		-4.24	-1.56	30 min
Mindfulness-Based Stress Reduction therapy (MBSR) (Palta P, Page G,)		-21.92	-16.70	60 min
Transcendental Meditation (TM) (Schneider RH, Grim CE)		-8.3	-1.5	60 min
yogic relaxation (Montfrans G, Karemaker J)		-	-3	30 min
Transcendental meditation (Nidich SI, Rainforth M V,)		−2.0	−1.2	60 min
Heart Rate-Biofeedback (HR-BF)		-10	-10	30 min

Table.24. Comparison of present study with previous studies

Mechanism:

LSP is a yogic cleansing technique which involves the consumption of warm water followed by set of *yogic* postures which lead to purgation. After coming loose motions the participant lies down and relaxes in *śavāsana*. This procedure has caused reduction in BP in our study. The mechanism behind such reduction could be explained on the basis of an aphorism from an ancient *yoga* text called *Manḍukya kārika* (1.44), which describes that a deeper state of relaxation can be achieved if the relaxation is preceded by stimulation, than relaxation alone. Here, in our case this *kriyā* of LSP acts as a deep stimulation for the autonomic nervous system. When the participant lies down in *śavāsana* after LSP, he enters into a state of still deeper relaxation which leads to parasympathetic dominance and thereby reduction in BP.

Secondly, The *āyurvedic* point of view the process of purgation is known as *virecana*, which is equivalent of LSP. There are studies which have observed reduction in BP after *virecana* procedure.[106,107]

Triphalā, which is *tridośa śamaka* and LSP having *pitta śamaka (virecana)* property, the combined intervention removes vitiated *tridośas* (toxins) with less effort from our body by the way *triphalā* having a mild diuretic in nature. Thus the *tridośas* vitiation of *adika raktacāpa* will come to normal level by the correction of vitiated by *dośa*[108].

CHAPTER 7

7. SUMMARY AND CONCLUSION

7.1. SUMMARY

āyurveda and *yoga* are the ancient sciences; the former focuses more on the physical aspect and later more on the psychological aspects of the human existence. *Yoga* offers many techniques including *āsanas* (physical postures), *prānāyama* (breathing techniques), *kriyas* (cleansing techniques), meditation and different types of relaxation techniques. Recent studies on *kriyas (kaphalabhati)* have shown their role in the management of different types of lifestyle disorders. The traditional practices of *āyurveda* and *yoga* recommend bowel clearing as the prerequisite for ensuring the efficacy of any of the therapies that follow. *Laghu ŚankhaPrakśālana* is one of the *kriyas* mentioned in the ancient *yogic* texts for clearing the bowel with a structured protocol of practices. To date there are no published scientific studies that have evaluated the effect of LSP or LSP with *triphalā* (a *āyurvedic* herbal preparation) in hypertension. Hence this study was designed with an aim to compare the immediate effect of an LSP with plain water and LSP with water mixed with *triphalā*, an herbal preparation, as recommended as *tridośa śamaka* and other variables were documented as recommended in *āyurveda*. Blood pressure and other variables were documented immediately before and after the session. We found that LSP performed using plain water or with the water mixed with *triphalā* reduce the blood pressure significantly ($p<0.001$).

Along with blood pressure other variables like pulse rate and respiratory rate also reduced immediately. Many studies have shown the effect of the usual module of IAYT for HTN that includes *āsanas, prānāyama* and meditations but *kriyas* are kept away as this may increase the blood pressure. This study shows that LSP *Kriya* is safe and effective. It has also shown the safety of the modified version of LSP as the clearing of the bowel was much better LSP done using mixed with *triphalā* powder.

This study also has shown the effectiveness of weeklong IAYT therapy in improving the quality of life (GHQ) ($p<0.001$), sleep ($p<0.001$), *bhrāmari* or BHT (breath holding time) ($p<0.001$) and comfort ($p<0.001$) level; weeklong IAYT also can decrease the medication

score (p<0.001), symptom score (p<0.001), State (p<0.001) and trait anxiety level (p<0.001), fatigue (p<0.001) & BMI (p<0.001).

7.2. CONCLUSIONS

a) This study has demonstrated that it is feasible and beneficial to integrate LSP in management of hypertension in an inpatient setting with no side effects.
b) The BP, Pulse & Respiratory rate reduce immediately after LSP and hence is safe.
c) LSP with *triphalā* water is acceptable and helps in clearing the bowel with lesser effort.
d) One week of intensive therapy with specific IAYT practices for hypertension improves QOL, lung capacity (exhalation time/ *bhrāmari* time); it also reduces BMI and anxiety level.

7.3. SUMMARY TABLES:

Variables		NW LSP		% change	Sig* p	TW LSP		% change	Sig* p
		Pre	Post			Pre	Post		
BP	**Sys (MmHg)**	137.25±16.3	127.81±12.8	6.88	0.001	141.8±19.2	125.5±13.9	11.4	0.001
	Dia (MmHg)	86.43±9.4	80.68±8.0	6.62	0.001	87.5±10.15	78.40±8.2	10.4	0.001
Pulse		83.5±9.8	77.28±7.09	7.44	0.001	83.06±8.09	75.56±7.6	9.02	0.001
RR		18.71±3.29	17.56±3.05	6.14	0.001	18.3±2.6	16.28±1.92	11.03	0.001
No. Stools			1.78±0.87				3.3±1.00	-85.39	0.001

*NW-Normal water, *TW- *Triphalā* water, *LSP- *laghu śankhaprakṣālana*

Table.27. Summary of primary outcome measures

No.	Variables		Pre	Post	% change	Sig* p
1	BMI (kg)		28.63±4.14	27.73±4.40	3.14	0.004
2	BHT (Sec)		16.18±5.30	19.25±6.27	-18.97	0.001
3	Symptom Score		4.12±2.69	1.40±1.34	66.01	
4	Medication score		1.0312±0.40	0.6875±0.418	33.98	0.001
5	Fatigue		4.53±1.60	2±2.04	55.84	0.001
6	Comfort		6.43±1.79	8.59±1.04	-33.59	0.001
7	GHQ		3.06±4.62	0.5±1.21	83.66	0.001
8	STAI	State Anxiety	39.68±8.16	26.06±5.82	34.32	0.001
		Trait Anxiety	41.59±9.70	30.71±6.46	26.16	0.001
9	Sleep	Time taken to fall asleep (Min)	31.40±12.90	22.81±7.06	27.35	0.001
		Duration of Sleep (Hrs.) /night	6.71±1.08	6.87±0.87	-2.38	0.503
		Feeling of freshness on waking	7.18±1.74	8.75±0.87	-21.86	0.001
		No. of interruptions	2.21±1.15	1.53±0.80	30.76	0.001

Table.28. Change in variables after weeklong IAYT

CHAPTER 8

8. APPRAISAL

8.1. STRENGTHS OF THE STUDY

1. This is the first study that has looked at the effect of LSP and a modified version of LSP.
2. Provided the first evidence for the safety of this practice in hypertensives.
3. The first study evidence of the offer spoken fact about bowel cleansing and its role in the management of hypertension according to CAM therapies.
4. Intensive supervised acceptable module of integrated approach of *yoga* therapy. That has shown favorable results within on a comprehensive battery that was designed to look at the mind and body.
5. Practice taught under complete supervision by a trained *yoga* therapist.
6. The holistic approach to manage hypertension that would help them in life change and long term compliance.
7. This study provides the scientific evidence for promoting and recommending *yoga* for hypertension as a cost effective module for enhancing the physical & psychological state of hypertension, which does not require any gadgets or need to create a gym or a park.

8.2. LIMITATIONS OF THE STUDY

1. This was a single arm study with pre-post design.
2. Short term design.
3. Selection of the study sample was convenient sampling that could not be a true, representation of the population.

8.3. SUGGESTIONS FOR FUTURE STUDIES

1) Based on the current study, the study exploration suggestions for future studies are;
2) Studies in other ethnic groups and other age groups to check for the safety and feasibility of introducing LSP.
3) Compare LSP with simpler methods of bowel clearing.
4) Evolve simplified version of LSP and LSP with *tripahalā* water.

5) Follow-up for compliance of life style and checking for relapsing of blood pressure will throw light on the feasibility of this holistic approach of *yoga* therapy for long term promotion.
6) Studies may be designed to compare the effect of *yoga* life style change with conventional life style in hypertensives.
7) Studies using more objective and molecular measurements in a large sample to see the relationship between bowel clearing and blood pressure management.
8) Studies to understand the paradigm of the etiopathology of blood pressure as described in yoga and *āyurved* texts.

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