Therapeutic Effects of *Yoga* on Hypertension (A Systematic Review)

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***Abstract*: Hypertension is a serious medical condition because it often has no warning signs or symptoms but rarely can be seen some signs and symptoms. According to modern medicine hypertension or high blood pressure (HBP) is defined as two levels; (1) elevated BP with a systolic pressure (SBP) between 120 and 129 mmHg and diastolic pressure (DBP) less than 80 mmHg and, the (2) SBP is in between 130 to 139 mmHg or a DBP is 80 to 89 mmHg. Ayurvedic scholars have come up with various names for high blood pressure such as *Raktagata Vãta, Sirãgata Vãta, Avrita Vãta, Dhamani Prapurana, Rakta Vikshepa, Vyana Prakopa, Raktamada, Uchharaktachapa*, and *Vyãna Atibala* etc. Untreated hypertension condition can affect the heart, brain, kidneys and eyes, leading to later development of diseases. *Yoga* therapies have healing power and effect on the energy flow of the body as well as it is good for the relaxation.**

This study is a literature review; searches were carried out to find out the effects of *Yoga* on hypertension related to decreasing the Systolic and diastolic pressure, by using popular search engines, including Google, Google Scholar, PubMed, Research gate, semantic scholar, the Cochrane Central Register of Controlled Trials (CENTRAL), and Ind MED within the period of 06 months. Twenty-seven articles were reviewed and 100% of the articles showed (directly or indirectly) *Yoga* has a positive effect on hypertension by reducing systolic blood pressure and diastolic blood pressure.

The present study found that *Yoga* has a safe and effective treatment for Hypertension by reducing systolic and diastolic blood pressure. Also, it is free from any adverse effects.

***Keywords: Yoga*, hypertension, cardiovascular system.**

I. INTRODUCTION

The human heart goes about as a pump because it supplies oxygen-rich blood to different body organs through the veins and pumps the oxygen-poor blood back to the lungs to get energized with new oxygen. Blood pressure is the power applied by the blood when it flows against the walls of the veins. Any kind of blockage in the veins such as cholesterol stores, blood clumps, and narrowing of the veins because of solidifying would urge the blood to apply more weight while it flows. This is what leads to the problem of hypertension. The higher the pressure the harder the heart has to pump. There are many treatment methods and procedures to prevent hypertension in both modern and Ayurveda.

Nowadays, high blood pressure is a major health problem among the public and it leads cause of death and disability in developing countries. A quarter of the world's adult population suffers from high blood pressure, and by 2025 this is likely to rise to 29% [1]. "Yoga is a Sanskrit word derived from the Sanskrit root "*Yuj*" which means to connect, join or balance [2]".Body and mind are the main concerning factors of Yoga. More recently, Yoga has become more popular as a form of physical exercise based upon poses (*Asana*), breathing techniques (*Pranayama*), Om recitation, Gestures (*Yoga Mudra*) and meditation that promotes improved control of the mind and enhances well-being.

How Yoga reduce blood pressure:

Yoga helps to lower the blood pressure naturally and reduce hypertension induced by stress conditions. Relevant; Yoga *Asanas* (E.g. : *Uttanasana* -Standing forward bend pose, *Viparita Karani* -Legs-up-the-wall pose, *Balasana*-child pose, *Adho Mukha Svanasana* -Downward-facing dog pose, and *Pashchimottanasana* - Seated Forward Bend Pose) Pranayama(E.g *Anuloma Viloma* P.-alternate nostril breathing, *Bhramari* P.-Humming Bee breath), Yogic meditation and some of other yoga practices (E.g: *Yoga Nidra*) reducing hypertension by stimulating Parasympathetic domain.

The parasympathetic system regulates blood pressure in resting conditions and prevents unusual increasing in blood pressure. When blood pressure is increased, it detects by the baroreceptor system. Then the baroreceptor reflex stimulates the parasympathetic system. Parasympathetic domain relaxes the blood vessels, decreases the total peripheral resistance, and decreases heart rate. Because of this procedure; the blood pressure comes back to the normal level [3].

Yogic breathing practices (*Pranayama*) produce inhibitory signals from action of slowly adapting receptors and hyperpolarizing currents; because this practice stretches the lung tissues. These inhibitory signals from cardiorespiratory region act on vagi. Parasympathetic dominance is occurred in the body because of this action. Various inflatory and deflatory lung reflexes are modified by yogic breathing techniques. They interact with central neural element. It helps to maintain a healthy body via homeostasis. The other study done using Pranayama (Bhastrika-bellows breath) in 2011 with fifty healthy males showed an increase in parasympathetic activity. It also showed reduction in heart rate, reduction in sympathetic activity, and reduction in systolic blood pressure [4].

Yogic meditation influences ascending reticular activating system and interact with autonomic centers in the brain stem. It effects on cardiorespiratory parameters. Meditation improves the melatonin levels. It helps to make a person healthy via regulating circadian rhythm [5].

Study done in 2011(with 15 days regular Pranayama and mediation practice) showed reduction in resting pulse rate, systolic blood pressure, diastolic blood pressure, and mean arterial blood pressure [6].

There have been several studies on the psychophysiological and biochemical changes that have taken place after the practice of Yoga over the past few decades. One of the major benefits of Yoga practice is that can stay healthy regardless of genetic predisposition and environment. Yoga also helps to maintain and sustain this dynamic health in life [7].

Yoga is a main therapeutic method for regulating hypertension but most of instructors and practitioners are mainly focus on the Asana and Pranayama but few of them focused on *Yoga Mudrã* and *Yoga Nidrã*.

Justification:

Yoga therapies have healing power and positive effects on the energy flow of the body as well as being good for the relaxation. Yoga reduces hypertension and maintains blood pressure in normal levels. Therefore it is important to find out the therapeutic effects of Yoga on hypertension by a systematic review because it is very useful as a supplementary therapy for hypertension in addition to medical treatments.

Objectives

General Objective:

To evaluate the Therapeutic effects of *Yoga on* Hypertension.

Specific Objectives:

i) To identify the therapeutic effects of *Yoga* on systolic blood pressure.
ii) To identify the therapeutic effects of *Yoga* on diastolic blood pressure.

Hypothesis:

1H1: There are therapeutic effects of *Yoga on* Hypertension.

1H0: There are no therapeutic effects of *Yoga on* Hypertension.

2H1: There are therapeutic effects of *Yoga* on systolic blood pressure.

2H0: There are no therapeutic effects of *Yoga* on systolic blood pressure.

3H1: There are therapeutic effects of *Yoga* on diastolic blood pressure.

3H0: There are no therapeutic effects of *Yoga* on diastolic blood pressure.

II. LITERATURE REVIEW

Review on Hypertension:

According to modern concept hypertension or high blood pressure is defined as two levels; (1) elevated BP with a systolic pressure (SBP) between 120 and 129 mmHg and diastolic pressure (DBP) less than 80 mmHg and, the (2) SBP is in between 130 to 139 mmHg or a DBP is 80 to 89 mmHg [8].

The “silent killer” is another name for hypertension because it often has no warning signs or symptoms but rarely, it can cause symptoms like headaches or vomiting. But the most important thing is uncomplicated hypertension can persist for years, even decades without showing any symptoms. However some symptoms begin to show due to damage to the vascular system. They can include dizziness, shortness of breath, headache, and blurred vision. Other possible symptoms and sing are nose bleeding, blood in urine, fatigue, chest pain and pounding sensation in the neck, chest or ears. Malignant hypertension is one of the medically emergency conditions that can cause stroke. Also it can develop kidney failure may experience a decrease in urine output and swelling (edema) in the lower extremities [9].

Courses for hypertension are eating too much salt, not eating enough fruits and vegetables, don’t have enough exercises, drink too much alcohol or coffee, smoking, age over 65 and etc [10].

There are risk factors for hypertension. They can be divide in to two categories as modifiable and non-modifiable. Unhealthy diets (excessive salt consumption, a diet high in saturated fat and trans fats, low intake of fruits and vegetables), physical inactivity, consumption of tobacco and alcohol, and being overweight and obese are modifiable risk factors.
Family history of hypertension, age over 65 years and co-existing diseases such as diabetes or kidney disease are non-modifiable risk factors. Prevention of hypertension can be achieved by reducing salt intake (to less than 5g daily), eating more fruit and vegetables, being physically active on a regular basis, avoiding use of tobacco, reducing alcohol consumption, limiting the intake of foods high in saturated fats, and eliminating/reducing trans fats in diet according to the WHO. Reducing hypertension prevents heart attack, stroke, and kidney damage, as well as other health problems. Reducing and managing stress, regularly checking blood pressure, treating high blood pressure, and managing other medical conditions are the methods for the management of hypertension [11].

According to Ayurveda concept hypertension can be describe as follows;

Various theories have been proposed in Ayurveda to explain high blood pressure, but there is no clear agreement between them. An attempt has been made to present a clear definition of the applied physiology and etiopathogenesis of hypertension in Ayurvedic principles. Hypertension in

Ayurveda cannot be considered as a disease without specific symptoms in mild to moderate stages. It is an early stage of pathogenesis and is said to affect the heart, brain, kidneys, and eyes, leading to the later development of diseases. Many parallels theories have been drawn to gain a deeper understanding of concepts such as *Shad Kriyakala* (six stages of *Dosha* imbalance) and *Avarana* of *Doshas* (occlusion in the normal functioning of the *Doshas*) to the modern pathogenesis of hypertension. Although not genetically inherited, major causes such as junk food and modern sedentary lifestyles can affect high blood pressure. Ayurvedic scholars have come up with various names for high blood pressure such as *Raktagata Vata, Siragata Vata, Avrita Vata, Dhamani Prapurana, Rakta Vikshepa, Vyana Prakopa, Raktamada, Uchharaktachapa*, and *Vyana Atibala* etc [12].

"It is the *Prana Vata* situated in the *Moordha* (Brain) [Ashtanga Hridaya, Sutra Sthana, 12/4] that controls the *Hridaya* (heart) and does *Dhamani Dharana* (arterial perpetuation) and thus heart rate is controlled by *Prana Vãta* [12]".

Review of Yoga.

Ayurveda was governed by six main philosophies of ancient India. They are *Sankhya, Vaisheshika, Jaina, Yoga, Charwaka* and *Mimamsa*. *Yoga* is the practical side of *Sankya* philosophy. *Yoga Darshana* was introduced by Pathanjali Maha Rishi is known as the founder of *Yoga Darshana*. *Srimad Bhagawad Geetha, Hata Yoga Pradeepika, Pathanjali Yoga Sutra, Geranda Samhita, Shiva Samhita* and *Hatha Ratnavali* are the main texts, mentioned about *Yoga Darshana*.

The *Bhagavad Gita* is perhaps the most famous of all Indian scriptures and is considered one of the world's spiritual and literary text. This venerable and enduring book has been translated into more than seventy-five languages from the beginning of ancient India to its present day recognition as a spiritual masterpiece [13]. Hatha Yoga Pradipika is one of the classic Sanskrit manual of *Hatha Yoga* who is written by Syami Swathmarama. His mentor was Swami Gorakhanath. It consists of four chapters and was written in 15th century. *Pathanjali Yoga Suthra* was written around 400 CE by sage Pathanjali. There are 196 Sutras with Pathanjalis' commentaries. This is the most translated ancient Indian text, into forty Indian languages and two non-Indian languages. There are four chapters. They are *Samadhi Pada, Sadhana Pada, Vibhuti Pada* and *Kaivalya Pada.* The teachings of sage *Geranda* to his student *Chanda* are included in *Geranda Samhitha.Geranda Samhitha* is one of the three classic texts of *Hatha Yoga* (*Geranda Samhitha, Hatha Yoga Pradipika* and *Shiva Samhita*).Unlike other *Hatha Yoga* texts, the *Gheranda Samhita* mentioned sevenfold *Yoga*. They are *Shatkarma* for purification, *Asana* for strengthening, *Mudra* for steadying, *Pratyahara* for calming, *Pranayama* for lightness, *Dhyana* for perception and *Samadhi* for isolation [14].

There are various definitions for the word Yoga as follows. According to Bhagawad Geetha, Withdrawal of ones' mind from unhappiness and happiness is called *Yoga*. Skilled performance is *Yoga* [15], Bh. Gita 2/50). State of balance of body and mind is *Yoga*. [15],

Bh. Gita 2/48). According to Pathanajali Yoga Suthra [16], P.Y.S. 1/2); *Yoga* is the state of cessation of all mental modifications. (*Chittavrtti* means the fluctuations of the mind around the world of objects or mental modifications).

Great Rishis who knows *Yoga* describe this state as *Yoga*. *Yoga* is mainly focused on the human body and mind. Those *Yoga* practices have 5000 years of history in ancient Indian philosophy. In more recently, *Yoga* has become more popular as a form of physical exercise based upon poses that promote improved control of the mind and enhance well-being. One of the interesting thing is there is no written evidence about an inventor of *Yoga*. Both males and females are now more prone to follow *Yoga* to enhance the life span not also to prevent NCDs. Male *Yoga* practitioners called as *Yogins* and also the females called as *Yoginis.* Modern *Yoga* practitioners mainly focus on *Yoga* evolved with exercise, strength, flexibility, and breathing. *Yoga* is a way of life, an experiential science of human nature that enables to realize our real selves. "…Take up the study of *Yoga* science as you would any other science of material nature and remember that there is no mystery nor danger in it [17].

A study done in 2014; A Systematic Review and Meta-Analysis of Yoga for Hypertension showed that (7 RCTs with a total of 452 patients were included in the analysis) very low–quality evidence was found for effects of yoga on systolic and diastolic BP.

This study further said that "Given the possibly better risk/benefit ratio, it may be advisable to focus on yogic breathing techniques for hypertension management. Yoga should be considered as an adjunct intervention only and not be regarded as an alternative to antihypertensive medication" [18].

The philosophy of *Yoga* is to convey its spiritual message and guide sessions. There are six branches of *Yoga* represent a different focus and set of characteristics. Those are *Hatha Yoga, Rãja Yoga, Karma Yoga, Bhakti Yoga, Jnãna Yoga*, and *Tantra Yoga.* All of them are trying to achieve liberation, salvation or to attain *Samadhi*. There are many types and styles of *Yoga* but those are not more authentic or superior to another. It is really important to choose a type or style for the fitness level. Some of them are *Ashtanga Yoga, Bikram Yoga, Hatha Yoga, Iyenagar Yoga, Jivamukti Yoga, Kripalu Yoga, Kundalini Yoga, Power Yoga, Sivananda Yoga, ViniYog* and *Yin* [19].

Ashtanga Yoga consist of the important principles for living a meaningful and purposeful life. It serves as a prescription for moral and ethical behavior and selfdiscipline. They focus on one's health and acknowledge the spiritual aspects of nature.

Patanjali has described *Ashtanga Yoga*. It includes eight stages of *Yoga*. It is the pathway to attend liberation (*Moksha*).

They are as follows:

1. *Yama* (Ethical rules).
2. *Niyama* (Observances).
3. *Asana* (Meditative Postures).
4. *Pranayama* (Control of breathing /Energy control).
5. *Pratyahara* (Withdrawal of mind from sense objects).
6. *Dharana* (Concentration).
7. *Dhyana* (Meditation).
8. *Samadhi* (Absolute contemplation).

The first five of these are called as *Bahiranga Yoga* and next three are mentioned as *Antaranga Yoga* [16], P.Y. S. 2/29).

Yama: This is literally means principles or moral code of life. The science of *Yoga* considers every aspect of human life. When considering a person, *Yoga* focused and taught about the physical body as well as the mind and soul. Since a person is a subject belonging to the society, the society also considered as a science by *Yoga* [20].

- *Ahimsa* - A principle of non-violence.
- *Satya* - A principle of Truth fullness.
- *Asteya* - A principle of non- stealing.
- *Brahmacharya* - Continence / Celibacy.
- *Aparigah* - A principle of non-hoarding or non-possessiveness.

Niyama: This is literally means principles or moral code of life. The science of *Yoga* considers every aspect of human life. When considering a person, *Yoga* focused and taught about the physical body as well as the mind and soul. Since a person is a subject belonging to the society, the society also considered as a science by *Yoga* [20].

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Asana: The *Yoga* Sutras only mention the posture used for sitting and meditating, and this *Asana* description is suitable for every modern practice [21].

Pranayama: Regulation of breathing, known as *Pranayama* is considered to be an essential part of *Yoga* and is said to affect the systems of the body.

Prathyahara: *Pratyahara* is disconnection of the senses with outer world. It is a stage of pause full withdrawal of sense organs from sense objects. *Prathyahara* is an initial stage of thinking about self. A person cannot realize *Paramathma* in this stage. The two Sanskrit words; *Pratya* (belief) and *Athma* (bringing near or fetch) are combined to create the word *Prathyahara* [22].

Dharana: *Dharana* means practicing the concentration of the mind to one object and its field.

Dhyan: *Dhyan* means enhance the concentration of mind by focusing on one point and meditating while withdrawing the all external objects from the mind.

Samadhi: "Full concentration of the mind focused on one of those experiences [20]". The object of meditation is to be forgotten is *Samadhi* (Contemplation).*Samadhi* (समाचध) means "putting together, joining, and combining with, union, harmonious whole and trance [22].

Any of the above parts of *Ashtanga Yoga* can be used separately, but in *Yoga* philosophy, posture and breathing exercises prepare the mind and body for meditation and spiritual advancement. In the modern era, the most common elements of *Yoga* practice are the yogic postures, breathing techniques of *Yoga* and yogic meditation. *Yoga* improves the health of physical body mostly by using a series of postures (*Asana*s) and breathing techniques (*Pranayama*). The breathing techniques of the *Yogas* focus on prolonging the inhale, holding the breath, and exhaling. Combining physical body, breath and concentration during posture and movements removes blockages in the body's energy channels and makes the body's energy system more balanced [23].

Yoga Asana*:* Being the first accessory of *Hatha Yoga*, *âsana* is described first. It should be practiced for gaining steady posture, health and lightness of body.*Asana* is mentioned in *Pathajali's Yoga Sutras*, a collection of lectures compiled by the sage Pathajali in 400 C.E. This was the first text that symbolizes the practice of *Yoga* and is considered the basis of the classical *Yoga* philosophy. Sutra 2.46 describes the qualities required for *Asana* training: "*Stira Sukham Asanam*". In Sanskrit, S*tira* means strong, steady or stable, and S*ukha* means to be comfortable or relaxed. The seat is therefore described as a balance between stability and comfort. The *Yoga Sutras* only mention the posture used for sitting and meditating, and this *Asana* description is suitable for every modern practice. Regardless of the *Yoga* method professionals will generally be motivated to achieve a stable and comfortable position. There are different number of *Asana*s mentioned in several texts and Acharyas but Lord Shiva mentioned 84 *Asana*s in the text of *Hatha Yoga Pradipika*. Among them emphasize that the first four are necessary for attaining spiritual perfection [21].

Some of them are *Adhomukha Svanasana, Adhomukha Swastikasana, Adhomukha Virasana, Ardha Chakrasana, Ardha Matsyendrasana, Ardha Pavanmuktasana, Ardha Salabasana, Ardhahalasana, Ardhakati, Ardhamatsyasana, Ardhashalabhasana, Ardhkati Chakrasana, Balasana, Bharadvajasana, Bhujangasana, Bidalasana, Chakrasana, Chatus Pada Asana, Dandasana, Dwipad Uttanasan, Janu Sirsasana, Makarasana, Maricyasana, Matsyasana, Meru Asanaa, Naukasana, Padhastasana, Padmasana, Paschimottanasana, Pavanamuktasana, Sashasana, Shashankasana, Sukha Asana, Supta Baddha Konasana, Supta Swastikasana, Svanasana, Tadasana, Talasana,*

Trikonaasana, Upavisthakonasana, Ushtrasana, Uttaanpadasana, Vajrasana, Vakrasana, Veerasana, Vipareetakarani, and Virabhadrasana. Some of them are described as follows.

Adhomukha Svanasana.

The downward-facing dog pose, one of the most recognizable postures in *Yoga* known as lower oral *Svanasana* in Sanskrit, works to strengthen the core and improve circulation. Practicing this posture works to rejuvenate and full body stretch [24].

Ardha Matsyendrasana.

Sit and stretch the legs forward and keep them on the floor. Bend the right leg and place it under the left thigh, turn the left leg and place it near the right knee. Now lift the left arm across the left leg and grab the right ankle joint [25].

Adhomukha Virasana.

This is a variety of postures that can be used in different ways in a *Yoga* sequence. Fllowing the chest opening seats is a nice contrast. In addition, it can be used as a recovery point in a challenging sequence. Therapeutic applications include releasing the spine, relieving lower back pain, and opening the shoulders [24].

Ardha Pavanmuktasana.

"(Single knee bending). Lie on the supine posture, raise the single leg and slowly bend the knee and try to touch the forehead on the knee [25]".

Ardha Chakrasana.

It is difficult for many people to practice full wheel posture or say *Chakrasana* but it is a known fact that half wheel posture *(Ardhachakrasana)* is a more comfortable seat for practicing every day [26].

Bidalasana.

"Sit in *Vajrasana* and kneel down on the floor with placing the palms between the two knees, while inhaling arch the spine and look towards the navel region. While exhaling make a curve in the spine and look upwards [25].

Uttaanpadasana.

"Lie on the supine posture and slowly raise both the legs straight without knee bending. Maintain for 5 seconds with normal breathing. While exhaling slowly release both the legs without bending the knees [25].

Vîrâsana.

One foot is to be placed on the thigh of the opposite side; and so also the other foot on the opposite thigh, it's called *Vîrâsana*.

Review of Pranayama.

Regulation of breathing, known as *Pranayama* is considered to be an essential part of *Yoga* and is said to affect the systems of the body. The beneficial effects of *Yoga* breathing techniques on several physical and mental can be found. Some of them are neural cognition, psychophysiology, respiratory, biochemical, and metabolic functions were highlighted in healthy individuals. They were also found to be useful in managing various clinical conditions. Oxygen consumption is used by the body as a means of regulating metabolic activity. Increases oxygen consumption and thus monitors the overall metabolic rate while breathing through the right nostril, more than while inhaling the left nostril and alternate nostrils for the same duration [27].

Some of them are *Anuloma Vilom, Bhastrika, Bhramari Pranayama, Chandra Anuloma, Kapalbhati etc.*

Anuloma Viloma.

Anulom Vilom is a specialized controlled breathing exercise in *Yoga*. It involves closing one nostril when inhaling and closing the other nostril when breathing. The process is then reversed and repeated [28]. Patient has to sit in any comfortable meditative posture. He/she must keep the head and spine upright, relax the whole body and close the eyes. Then person should perform *Nasagra Mudra* with the right hand and should place the left hand on the knee in *Cin Mudra*. He/she must close the right nostril with the thumb and inhale through the left nostril. Patient must breathe deeply without strain. Then have to close the left nostril with the ring finger and release the pressure of the thumb on the right nostril and exhale. Next he/she should inhale from the right nostril, at the end of inhalation, close the right nostril and must open the left nostril. Then person must exhale through the left nostril. This is one round. He/she must do this procedure for 10 rounds.

Brasthika.

Bhasthri Pranayama is a process of rapid inhaling and exhaling that gives energy to the body and is therefore called yogic fire breathing [29].

Bhramari Pranayama.

Brumari Pranayama or bumblebee breathing is a calm breathing exercise that can be done anywhere. The word *Bhramari* is derived from the Sanskrit word "*bee*". This breathing exercise is named after a species of black Indian bee that makes a loud beelike sound during breathing. This

breathing exercise can relieve stress, anxiety and anger. It also helps to calm the body and mind before going to sleep [30].

Chandra Anuloma.

Make a nasal seal with your right hand. Close the right nostril at the tip of the thumb. Inhale and exhale slowly through the left nostril (*Chandra Nadi*) only. Always cover the right nostril during training. One cycle of inhaling and exhaling forms one round [31].

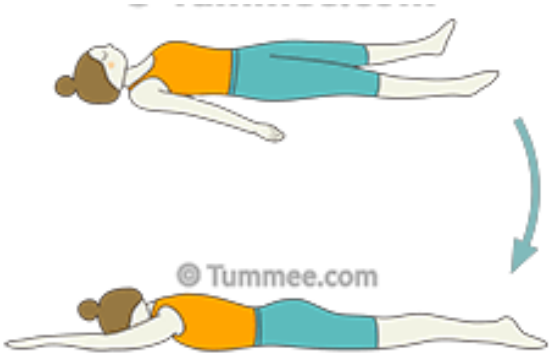
Kapalbhati.

Kapal Bhati literally translates as 'shining forehead'. This is exactly what happens when you practice regular exercise. Therefore, according to *Yoga* experts, *Kapalbhati* is something that guarantees a ‘shining forehead’, a symbol of a bright and healthy mind [32].

Savasana - Corpse pose.

This posture got its name from the repositioning of a corpse. It is a simplest pose used for rest and relaxation and is usually practiced at the end of a *Yoga* session [33].

Person must lie flat on the back full length like corpse. Then he /she must Keep the hands away from the thighs with palms upwards and close the eyes with both legs slightly apart. Then the person has to breathe deeply. Later the breathing should be fine and slow. His/her body and mind should be calm and quite. Person must concentrate on deep and fine inhalation and exhalation. Individual must relax the body completely from toes to head and breathe in and out slowly. Stay in the position for 15 to 20 minutes with concentration of the breathing with relaxed mind and relaxed body. Then he/she must turn to right side without opening the eyes and should come to the sitting position. He/she must rub the palms for 01 minute and should keep palms on both eyes and after that eyes should be opened.



Combine studies of Asanas and Pranayama.

Soorya Namaskara has positive physiological benefits as evidenced by changes in pulmonary function, respiratory pressures, handgrip strength and endurance, and resting cardiovascular parameters [34]. Combination of these two *Yoga* techniques improves general health and fitness, improves pulmonary functions and cardiovascular function. *Yoga* practices reduced the problems of aging [35] and [36]. Combinations of *Yoga Asana* and *Pranayama* reduced anxiety / depression and distress [37], [38]. It has effects of curing Arthritis and reducing pains due to the disease [39], [40]. *Yoga* Improves sleep quality, mood, stress, cancer-related distress, cancer related symptoms, and overall quality of life, as well as functional and physiological measures in cancer patients [41]. It has a beneficial effect on glycemic control and improve nerve function in mild to moderate Type 2 diabetes with sub-clinical neuropathy [42].

Yoga is beneficial for diabetes patients [43]. It has efficacy of improving the dyslipidemic state associated with diabetes [44]. *Ujjayi Pranayama* and *Shavasana* improve balancing the autonomic nervous system through enhancing para-sympathetic system. Therefore, they can be pre-scribed to hypertensive patients with proper monitoring, along with medical therapy [45]. A study combination of *Asana*,

Pranayama and meditation has proven; alterations of cardio vascular parameters according to aging are slower in persons with regular *Yoga* practice. Incorporation of *Yoga* is beneficial as a part of our life style in prevention of age related cardiovascular complications. [46]. Every individual, either healthy or prediabetic, should practice *Yoga* for prevention of Diabetes Mellitus [47].

Review of Yoga Mudra.

*Yoga Mudrã*s are symbolic or ritual gesture according to the texts. While some *Mudrã*s involve the entire body, most are performed using hands and fingers. Based on the principles of *Yoga*, *Mudrã*s are thought to have healing power and to have an effect on the energy flow of the body. *Mudrã*s are not only part of *Yoga*, but also of dance, *Tantra*, art and even martial arts. Practicing these *Yoga Mudrã*s mediates the mind and helps to heal emotionally and gives strength to keep the mind correctly by which stimulating the different parts of the brain and also promoting relaxation and calmness of the mind. Those are used to express and emphasize the intentions of the mind. Sometimes similar *Mudrã*s used in different classical dance forms. There are many types of *Mudrã*s teaches in *Yoga* and each of them has different benefits and stimulations to the brain [48].

Following *Yoga*, *Mudrã*s really help in balancing the energy of the body. In ancient text mentioned that the five fingers of the hand incorporate five elements of the world such as earth, air, fire, water, and ether (*Akasha* in Sanskrit). These five elements regulate and shown from the five fingers of the hand. Ring finger regulates earth, index finger regulates air, thumb finger regulates fire, pinky finger regulates water, and also the middle finger focus on the ether of the body [49]. *Yoga* is a pure and true way to cure the inner problems in the body. No need to work too hard to get it right.

Aakash Mudrã.

Out of all the *Mudrã* s for high blood pressure, this is an easy one and quick too. Join the tip of the middle finger to the tip of the thumb and hold it while exhaling inhaling for a few minutes. It is very helpful in getting rid of hypertension and all kinds of negative emotions.

Vaayan Mudrã.

Join the tip of the middle finger and index finger to the tip of the thumb finger for the Vaayan *Mudrã*. This helps in reducing blood pressure in the best way possible. Also known as *Vatta Katak Mudrã*, this *Mudrã* is helpful in increasing the *Vatta* humor of the body thereby increasing the never force and vital power of the body.

Apanavayu Mudrã.

While inhaling and exhaling, place the tip of the pointing finger at the bottom of the thumb. Then join the tips of the middle finger along with the ring finger with the tip of the thumb to form this *Mudrã*. This *Mudrã* is also very commonly referred to as the *Mudrã* of the heart. Not just hypertension but this *Mudrã* is also helpful in breathing difficulties, angina pectoris, heart attack, heart failure, etc. Everyday practice of this *Mudrã* is extremely helpful in getting rid of all kinds of heart blockages that help in regulating the blood pressure. In addition to this helps in oxygenating the blood while repairing any damage that might be done to the heart muscles for better health of the heart.

Pran Mudrã.

Bring together the tip of the little finger, ring finger and the thumb in order to perform this *Mudrã*. This *Mudrã* helps in awakening the power of *prana* immensely. Additionally, it also helps in getting rid of eye diseases, improving the eye sight, increasing the resistance of the body, removing any

feelings of tiredness and reducing the hunger pangs. A person who practices this *Mudrã* regularly sleeps well.

Surya Mudrã.

This *Mudrã* is one by letting the tip of the ring finger touch the base of thumb while exerting very little pressure on the ring finger. There is a significant improvement seen in the problem of hypertension with this *Mudrã*. It also helps immensely in increasing the body heat, it is extremely useful for people who have overweight problems and digestion problems. It also helps in reducing the cholesterol. The only precaution that must be taken while performing this *Mudrã* is that people who are weak should not practice it when it is hot.

Yoga exercises such as *Asana*, *Pranayama*, meditation and recitation Om increase blood circulation of the body. This helps to calm the mind and increase concentration skills.

Instruction of performing Yoga.

Before practicing *Yoga* to build characters, one must practice certain rules. The bladder and bowels should be emptied before looking at *Yoga* exercises. *Yoga* practitioners are advised to do *Yoga* exercises on an empty stomach in the morning. If you exercise other than in the morning, there should be an interval of at least 4 hours between eating and *Yoga*. The practitioner should perform joint movements to relax the joints before exercising. Wear light, clean, loose and stretchable fabrics. The place should be clean, quiet, safe and well ventilated. Women should not practice *Yoga* during the first four days of menstruation. After six months of surgery, one can practice *Yoga* with proper guidance. Patients and expectant mothers should practice *Yoga* under proper medical supervision. *Yoga* can be practiced 45 days after the normal delivery [50].

Yoga as a therapy

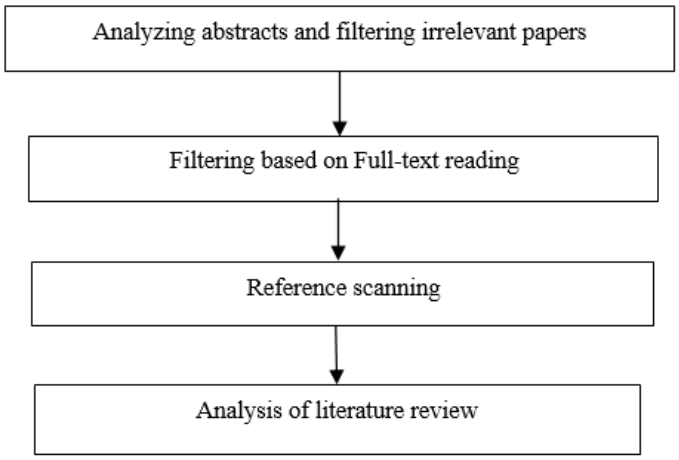
Today, psychosomatic disorders such as stress disorders, high blood pressure, hyperactivity, insomnia, hyperlipidemia, and heart disease are very common. Regular *Yoga* practice not only controls these diseases, but also promotes and maintains a healthy state of body and mind. Therefore, *Yoga* can be used as an individual treatment for relevant disease conditions or combined with Ayurveda or other therapies. But the nature of Yoga therapy (whether it could be used as individual/combine) may vary [18] according to the severity of the disease, and conditions of the patient

Yoga brings happiness to the profession and brings about positive changes in behavior patterns and positive attitudes. Society will also be better off because of the positive changes in interpersonal relationships. For these reasons, Western countries now practice *Yoga*. Vital energy flows through the nerves (channels) of the body. This flow fails due to various interruptions. According to the philosophy of *Yoga*, diseases are caused due to disturbances in the flow of vital energy. The relevant practices of *Yoga* (*Asana*, *Pranayama*, *Dharana*, meditation, *Samadhi*, and *Shad Kriya* etc.) can divert the soul energy to the right path providing positive effect for the disease to get cured.

III. MATERIALS & METHODS

Literature searches were carried out to find out the effects of *Yoga* on hypertension related to decrease the systolic and diastolic pressure, by using popular search engines, including Google, Google Scholar, PubMed, Research gate, semantic scholar, the Cochrane Central Register of Controlled Trials (CENTRAL), and IndMED were searched within the period of 06 months.

Systematic Review Method was carried out in this study.



Statistical Analysis

Data were analysed using percentages. The results were interpreted as percentages of the type of *Yoga*, used for the reduction of systolic and diastolic pressure to gain positive effect on hypertension within collected articles.

IV. DATA COLLECTION

No	Study Author	Topic	Subject	Intervention	Conclusion
1.	Agte *et al*., 2011.	The effects of *Sudarshan Kriya yoga (SKY)* on some physiological and biochemical parameters in mild hypertensive patients	113 subjects with mild hypertension and apparently healthy	26 hypertension (10 men, 16 women) 23 apparently health (10 men, 13 women) SKY practice completed - ***Pranayama*** - ***Asana*** - ***Sattvik* diet** for 2 months	Yogic breathing exercises not only help in relieving the stresses of life but also improve the antioxidant status of the individual [51].
2.	Balaji and Varne, 2017.	High sensitive CRP levels, Plasma renin activity and blood pressure among Hypertensive patients practicing *Yoga* exercises	45 subjects with hypertension	41 completed - ***Asana*** - ***Pranayama*** 1 hour for 6 months	Six months of *yoga* practice has significant effects by causing decrease in both systolic as well as diastolic blood pressure [52].
3.	Benardot *et al*., 2008.	Effects of *Yoga* on Inflammation and Exercise Capacity in Patients With Chronic Heart Failure	19 subjects	10 - control group 9 - *yoga* group - **Warm-up phase 10 min** - ***Asana* 40 min** - ***Pranayama* 20 min** twice per week over 8 weeks	*Yoga* therapy may offer more of a benefit to patients with heart failure as compared with conventional forms of exercise [53].
4.	Bhavanani *et al.*, (2012).	Immediate cardiovascular effects of *Pranava Pranayama* in hypertensive patients	29 subjects with hypertension	29 completed - ***Pranayama*** For 5 min	The practice of *Pranava Pranayama* is effective in reducing heart rate and systolic pressure in hypertensive patients [34].
5.	Bhavanani *et al.*, (2013).	Effects of eight week *yoga* therapy program on cardiovascular health in hypertensives.	15 subjects (9 male, 6 female)	15 completed - ***Asana*** - ***Pranayama*** - **Meditation** Total 60 min for 8 weeks	A comprehensive 8-week *yoga* therapy programme produces significant improvement in anthropometric and cardiovascular parameters and lipid profile in patients of essential HT. [54].
6.	Blom *et al*,. (2014).	Hypertension Analysis of Stress Reduction Using Mindfulness Meditation and *Yoga*: Results From the Harmony Randomized Controlled Trial	101 subjects prehypertension and stage 1 hypertension	Meditation and *yoga* vs. wait list control × 8 weeks	No significant change in blood pressure in either group [55].
7.	Cohen *et al.*, 2011.	*Iyengar Yoga (IY)* versus Enhanced Usual Care on Blood Pressure in Patients with Prehypertension to Stage I Hypertension: a Randomized Controlled Trial	78 subjects with pre hypertension and stage 1 hypertension. 32 – Diet group 46 – *Yoga* group	31 subjects completed diet intervention and 26 completed the *yoga* intervention. Diet versus *yoga* for 12 weeks - ***Asana* 45 min** - ***Pranayama* 5 min** For 12 weeks	The effects of IY on BP at 12 weeks as assessed by 24 h ABPM were comparable or greater than that produced by a EUC intervention in adults with prehypertension and stage 1 hypertension [56].
8.	Devi and Kala, 2015.	Role of *Yoga-nidra* and *Shirodhara* on Hypertensive Patients	32 subjects of hypertension	32 completed - *Takradhara* (*Shirodhara*) - 20 mim/ day for 14 days - *Yoga nidra* – 20 min/ day after *shirodhara* for 14 days	*Yoga nidra* can be used as a therapeutic technique to cure psychosomatic diseases like asthma, coronary heart disease, hypertension etc [57].
9.	Devi and Kumar, 2014.	Yogic intervention and its effect on hypertensive patients	20 subjects of essential hypertension	20 completed - **Prayer - 5 min.** - **Meditation - 15 min.** - ***Yoga nidra* - 30 min.** For a month.	*Yoga* is a safe and effective treatment for Hypertension that is free from any adverse effects and would maintain blood pressure [58].
10.	Devi, 2017.	Therapeutic Effect of Yogic Practices on the Management of Hypertensive Subjects	32 subjects of primary hypertension	- ***Pranayama*** - ***Prayer*** for 1 month	*Yoga* has been found to decrease blood pressure as well as the levels of oxidative stress in patients with hypertension [59].
11.	Dhungana *et al*., 2018.	Impact of a structured *yoga* program on blood pressure reduction among hypertensive patients: study protocol for a pragmatic randomized multicenter trial in primary health care	140 subjects of hypertension	a) Five days of *yoga* training (two hours per day) b) Two hours health education session on	This study can establish the extent to which a *yoga* intervention package can help reduce blood pressure in hypertensive patients [60].

		settings in Nepal		healthy lifestyles c) Home based self-practice of *yoga* daily for 90 days (with daily session lasting for 30 min). - warm-up exercise - *Asana* - *Pranayama* - Om recitation - relaxation - meditation in single or combination generally for 30 min/ day for 03 months	
12.	Gadham *et al.*, 2015.	Effect of *Yoga* on obesity, hypertension and lipid profile	50 male subjects with obesity, hypertension and dyslipidemia.	All completed - ***Asana* 30 min/ day** - ***Pranayama* 30 min/ day** every day for 3 months	There is a significant decrease in systolic blood pressure and diastolic blood pressure in subjects who have practiced *Yoga*, *Asana* along with *Pranayama* technique for 3 months duration [61].
13.	Jerusha, 2020.	Comparison of the effect of *yoga*, zumba and aerobics in controlling blood pressure in the Indian population	45 subjects	45 completed - Aerobic (15) - *Yoga* (15) * *Asana* * *Pranayama* * Meditation (*Savasana*) - Zumba (15) for 3 months	*Yoga* is an alternative to pharmacological approach which helps individuals to conquer hypertension at the early stages promoting primary care [62].
14.	Murugesan *et al.*, 2000.	Effect of selected yogic practices on the Management of hypertension	33 subjects with hypertension	33 completed - ***Asana*** - ***Mudra*** - **Om recitation** - **Meditation** Morning and evening 1 hour/ day, 6 days/ week for 11 weeks	*Yoga* intervention was more effective with drugs treatment [63].
15.	Parikh *et al.*, (2021).	Effect of Home based *Yoga* on Blood Pressure and Quality of Life in Patients with Hypertension	74 subjects of hypertension	74 completed - ***Pranayama*** - ***Savasana*** - **Spinal reflex** for 20 min/ day for 3 months	Patients with hypertension showed marked reduction in their blood pressure and improvement in quality of life after 3 months home based yogic exercise [64].
16.	Patil *et al.*, (2014).	Effect of *Yoga* on Oxidative Stress in Elderly with Grade-I Hypertension: A Randomized Controlled Study	60 subjects	57 completed Control group- 29 *Yoga* group- 28 - ***Asana*** - ***Pranayama*** - **Meditation** 1 hr/ day, 6 days/ week for 3 months.	*Yoga* is an effective means to reduce oxidative stress and to improve antioxidant defense in elderly hypertensive individuals [65].
17.	Prakash and Gupta, 2015.	To study the role of *yoga* in management of hypertension	50 subjects	50 completed - ***Asana*** - ***Pranayama*** ½ hr/ day, daily for 2 months	*Yoga* therapy in combination with conventional antihypertensive therapy was surely beneficial for the hypertensive patients and *yoga* should be added to the management of hypertensive in all the stages [66].
18.	Pushpanath an *et al.*, 2015.	Heart rate variability by Poincaré plot analysis in patients of essential hypertension and 12-week *yoga* therapy	70 subjects	60 completed 30- control group 30- *yoga* group - ***Asana*** - ***Pranayama*** - **Meditation** 45 min	*Yoga* therapy can reduce myocardial oxygen consumption and is instrumental in controlling high BP if practiced regularly along with medications [67].
19.	Roche *et al.*, (2017).	*Yoga* and self-regulation in management of essential arterial hypertension and associated emotional symptomatology: A randomized controlled trial	85 subjects	55 completed 1. Himalayan traditional meditation – 12 2. *Yoga* practice – 14 - ***Asana*** - ***Kriya***	*Yoga* practice is useful in clinical treatment of essential arterial hypertension and related emotional symptomatology, in public health context [68].

				- ***Mudra*** for 45 – 50 min - ***Pranayama*** for 5 min - ***ShavAsana*** for 10 – 15 min 3. *Pranayama* – 19 for 40 min 4. Control - 10	
20.	Santaella *et al*., 2014.	*Yoga* Relaxation (*Savasana*) decreases cardiac sympathovagal balance in hypertensive patients	46 volunteered	30 completed 16- hypertensive 14- normotensive - ***Savasana*** for 20 min	*Savasana* relaxation caused a reduction of cardiac sympathovagal balance [69].
21.	Saptharishi *et al*., 2009.	Community-based Randomized Controlled Trial of Non-pharmacological Interventions in Prevention and Control of Hypertension among Young Adults	113 subjects with prehypertension and hypertension	102 completed 1 - control (29) 2 - exercise (27) 3 - low sodium (25) 4 - *yoga* (21) - ***Pranayama*** - ***Asana*** 30- 45 min/ day, 5 days/ week	Exercise more effective than salt or *yoga* [70].
22.	Sathyanand a *et al*., 2016.	Effect of *Yoga* on Hypertension	100 subjects recruited from outpatient of cardiology department	100 completed - ***Pranayama*** - ***Asana*** Each of them 30 min for 3 months	Alternative approaches like *yoga Asana* and *Pranayama* methods serves as an adjunct method to lower blood pressure. [71].
23.	Subramani an *et al*., 2011.	Non-pharmacological Interventions in Hypertension: A Community-based Cross-over Randomized Controlled Trial	98 subjects with prehypertension and hypertension young adults	94 completed 1- Control (25) 2- Exercise (23) 3- Salt reduction (21) 4- *Yoga* (25) - ***Asana*** - ***Pranayama*** 45 min/day, daily for 2 months	The earlier RCT showed significant BP reduction with only *yoga* as an intervention [72].
24.	Sujatha, 2016.	Influence of a *Yoga* Program on Stress and Anxiety in Patients with Hypertension	238 subjects	238 completed 120- Control group 118- Studied group - ***Asana* 18 min** - ***Pranayama* 12 min** - **Meditation 12 min** 30- 45 min/day, 5 days/ weeks for 12 weeks	*Yoga* practice may represent an effective intervention in patients with hypertension to reduce BP, stress, and anxiety [73].
25.	Tamba *et al.*, 2021	The Effect of Hatha *Yoga* Therapy on the Blood Pressure of Primary Hypertension Patients of Productive Age	64 subjects	64 completed 32 control group 32 study group - ***Pranayama*** - ***Asana*** - ***Meditation*** 35 min/ day,	Resulted effect of hatha *yoga* and amlodipine therapy in reducing blood pressure is recommended to hypertensive patients [74].
26.	Vijayalaks hmi *et al.*, 2004.	Modulation of stress induced by isometric handgrip test in hypertensive patients following yogic relaxation training	13 male subjects with uncomplicated essential hypertension.	- ***Asana*** - ***Pranayama*** Monday through Saturday for 4 weeks	*Yoga* training optimizes the sympathetic response to stressful stimuli like isometric handgrip test and restores the autonomic regulatory reflex mechanisms in hypertensive patients [75].
27.	Wolff *et al.*, 2013	Impact of *yoga* on blood pressure and quality of life in patients with hypertension – a controlled trial in primary care, matched for systolic blood pressure	83 subjects with hypertension	1. Control (27) 2. *Yoga* class (28) 3. *Yoga* at home (28) - ***Asana* (4 min)** - ***Pranayama* (11 min)**	Simple *yoga* exercises may be useful as a supplementary blood pressure therapy in addition to medical treatment [76].

V. RESULTS

Twenty-seven articles were reviewed and 100% of the articles showed (directly or indirectly) *Yoga* has positive effect on hypertension by reducingsys to licblood pressure and diastolic blood pressure.

Method	No of considerations	As a percentage
Asana	21	32 %
Pranayama	23	35 %
Meditation	13	20 %
Yoga Mudra	2	3 %
Yoga Nidra	2	3 %
Om recitation	5	7 %

According to the articles found, there were twenty-one articles mentioned that *Yoga Asanas* are effective for hypertension by reducing systolic blood pressure and diastolic blood pressure.

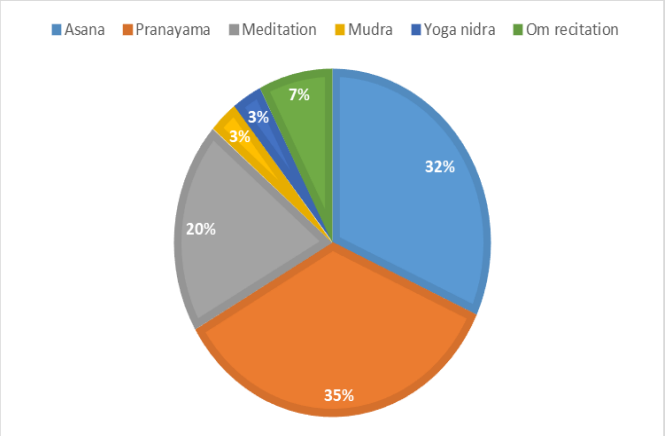
They are containing Loosening exercise such as toe bending, ankle bending, knee bending, half butterfly, finger bending, wrist bending, elbow bending, shoulder rotation, neck bending up and down also poses such as, *Adhomukha Svanasana, Adhomukha Swastikasana, Adhomukha Virasana, Ardha Chakrasana, Ardha Matsyendrasana, Ardha Pavanmuktasana, Ardha Salabasana, Ardhahalasana, Ardhakati, Ardhamatsyasana, Ardhashalabhasana, Ardhkati Chakrasana, Balasana, Bharadvajasana, Bhujangasana, Bidalasana, Chakrasana, Chatus Pada Asana, Dandasana, Dwipad Uttanasan, Janu Sirsasana, Makarasana, Maricyasana, Matsyasana, Meru Asanaa, Naukasana, Padhastasana, Padmasana, Paschimottanasana, Pavanamuktasana, Sashasana, Shashankasana, Sukha Asana, Supta Baddha Konasana, Supta Swastikasana, Svanasana, Tadasana, Talasana, Trikonaasana, Upavisthakonasana, Ushtrasana, Uttaanpadasana, Vajrasana, Vakrasana, Veerasana, Vipareetakarani, and Virabhadrasana.*

There were twenty- three articles mentioned that *Yoga Pranayamas* were effective for hypertension by reducing systolic blood pressure and diastolic blood pressure. Used breathing techniques as followed, *Anulom Vilom, Bhastrika, Bhramari Pranayama, Chandra anuloma, Chandranadi Pranayama, Chandravedi Pranayama, Kapalbhati, Nadishodhana, Pranav Pranayama, Savitri Pranayama, Savitri, Sheetali Pranayama, Shitkari, Surya Bhedana, Ujjayi Pranayama, Vibhag Pranayama* and *Vyagrah Pranayama.*

- Thirteen articles mentioned that meditation were effective for hypertension by reducing systolic blood pressure and diastolic blood pressure. Used method is *Savasana,* the corpse posture.
- According to the present study , there were two articles mentioned that *Yoga Mudrã* are effective for hypertension by reducing systolic blood pressure and diastolic blood pressure. •□Two articles mentioned that *Yoga Nidra* were effective for hypertension by reducing systolic blood pressure and diastolic blood pressure.
- Five articles mentioned that five chanting of Om were effective for hypertension by reducing systolic blood pressure and diastolic blood pressure. Thus, most of the time, researchers have focused on *Pranayama* itself.

The least number of times *Yoga Mudra* and *Yoga Nidra* have been considered.

The percentages can be calculated as shown in the table below.



VI. DISCUSSION

It is a known fact, that drugs used by society for high blood pressure are associated with a number of unwanted side effects. In addition to medicine, it is well known that moderate to intense physical exercise can lower the blood pressure [77].

Interestingly, the above studies have shown that high blood pressure can be successfully controlled by practicing *Yoga* per day for several months as a medical treatment for high blood pressure in people with hypertension. The above results confirm that *Yoga* has been found to have a reliable antihypertensive effect with relaxation, bio-nutrition, supernatural meditation and psychotherapy “Tests proved a progressive attenuation of sympatho- adrenal and renin-angiotensin activity with yogic practice. *Yogic* practice, through the restoration of baroreceptor sensitivity, caused a significant reduction in the blood pressure of patients who participated in *Yoga* exercise [77].

Yoga practice has a big potential to manage secondary heart complications caused by chronic high blood pressure. Chronic hypertension causes many heart complications, such as left ventricular hypertrophy, heart attack, and diastolic dysfunction. It has been shown that cardiovascular response, especially head-down-body-up postural exercise (*Sarvangasana*), is particularly beneficial in preventing and treating left ventricular hypertrophy and diastolic dysfunction associated with hypertension [78].

Breathing while performing *Pranayama* is boost the brain by supplying more oxygen to better function. One third of all the oxygen after one breath, goes directly to the brain thus it helps to maintain optimum function of the brain [78].

VII. CONCLUSION

The present study found that *Yoga* has safe and effective treatment for Hypertension by reducing systolic blood

pressure and diastolic blood pressure (100%). Especially *Asana* and *Pranayama* are very important *Yoga* therapies for the management of hypertension according to the findings. *Yoga* Therapy for hypertension is free from any adverse effects; such as *Asanas* (Eg: *Adhomukha Svanasana*, *Adhomukha Swastikasana*, and etc),

Pranayamas (Eg: *Anulom Vilom*, *Bhastrika*, and etc). Om recitation, *Yoga Mudra*s, and *Yoga Nidras* also beneficial in the management of hypertension by reducing systolic BP and diastolic BP.

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