1 Introduction

There is a growing trend in the epidemiology of chronic non-communicable disorders [NCDs] since last few decades. NCDs have become a leading cause of morbidity and mortality worldwide (Heron, 2012). Nearly 80% annual deaths are due to NCDs. Cardiovascular disease (CVD), cancer, obesity; type 2 diabetes mellitus are the most common NCDs (Wagner,2012). Cardiovascular disease comprises of 50% deaths due to NCDs (Nishtar, 2002). Hypertension is one among the most common CVD and a leading cause of significant deaths due coronary artery disease and stroke (Khan, 2010).

Table 1: 6 major NCDs leading causes of death in years 2013

Serial No.	Disease
1	Cardiovascular disease
2	Cancer
3	Chronic lower respiratory disease
4	Accidents
5	Stroke
6	Alzheimer's disease

1.1 Hypertension

The term hypertension (HTN) refers to a medical condition which is characterized by chronic elevated blood pressure (Naish, 2014).

Blood pressure is the pressure exerted by the blood on to the wall of the arteries during ventricular contraction and relaxation. Pressure during ventricular contraction is called systolic blood pressure (SBP) and pressure during ventricular relaxation is called diastolic blood pressure (DBP). Optimal SBP and DBP are less than 120-135 mmHg and 80-85 mmHg respectively.

1.2 Disease burden

HTN is a major public health concern both in developing and developed countries (Kearney, 2004).13% of annual premature deaths are due hypertension (Bhansali, 2015) & it is directly responsible for 16.5% of all deaths, among these 51% due to stroke and 45% due to heart disease (Santulli, 2013). HTN is a leading cause of factor for CVD, contributing to 54% of stroke and 47% of ischemic heart disease (Quereshi, 2005; Wu, 2013; Lawes, 2001).

More than 50% of subjects with diabetes know to develop hypertension. Hypertension increases the risk of diabetic complication in T2DM persons (Colosia, 2013). Prevention and management of hypertension remain a challenge in many corners of the world including India.

1.3 Prevalence of HTN

1.3.1 Global prevalence

There is progressive trend in the prevalence of hypertension all over the globe since last few decades. Around 40% of world population above 25 years age found to had hypertension in 2008 known to have hypertension and it is predicted to increase to 60% by the year 2025(Alverez-Erviti,2010; WHO, 2013; Chow, 2013).

1.3.2 Prevalence in India

Prevalence of hypertension is found to be consistently increasing in India. Overall prevalence for hypertension in India was 29.8%; in rural and urban prevalence of HTN is 27.6% & 33.8% respectively. Further, prevalence of HTN in rural north, east, west, and south India was 14.5%, 31.7%, 18.1% , and 21.1% respectively and in urban north, east, west, and south India it was 28.8%, 34.5%, 35.8%, and 31.8% respectively (Anchala, 2014).In India highest prevalence of HTN is found in urban west region. A survey found that the highest prevalence of HTN was in Mumbai and urban city with lowest prevalence rate of HTN was Chennai.

Table 5: Prevalence of hypertension in India

Regions	North (%)	East (%)	West (%)	South (%)	Overall (%)
Rural	14.5	31.7	21.1	18.1	27.6
Urban	28.8	34.5	31.8	35.1	33.8

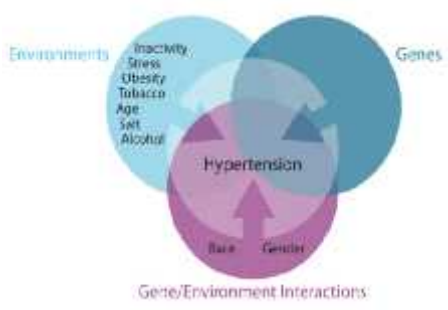
The table shows the distribution of HTN prevalence across the India in with respect to urban and rural area.

1.4 Causes of hypertension

The exact cause of essential hypertension is not known, but it is considered to be results of complex interaction between genetic and environmental factors. Following are considered as environmental risk factors for hypertension:(1) Obesity, High alcohol intake, High salt intake (in salt-sensitive patients), Aging, Sedentary lifestyle, Stress, Low potassium intake, Low

calcium intake. Furthermore, many of these factors are additive, such as obesity and alcohol intake(J Hypertens, 1988; Saver,1989)Figure 1: Causes of hypertension

Genetically prone individuals when exposed to environments triggers mention above develop hypertension.



1.5 Autonomic dysfunction in hypertension

Growing evidences showed involvement of autonomic dysfunction in various health conditions. Several chronicsuch as stroke, multiple sclerosis, Parkinson's disease, cardiovascular diseaseshows dysfunction is characterized by increased sympathetic activity and decreased vegal tone(Malliani, 1994; Dresdale, 1954; Schemidt, 2005).

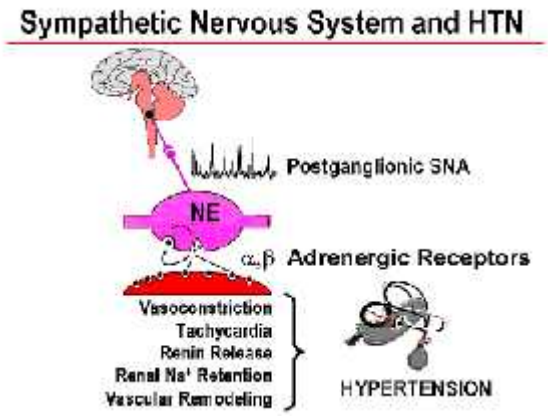
Autonomic nervous system plays a central role in maintaining cardiovascular homeostasis via pressure, volume, and chemoreceptor signals. It functions by regulating the peripheral vasculature, and kidney function, which in turn affect cardiac output, vascular resistance, and fluid retention. Prolonged hyper- activity of the sympathetic nervous system increases blood pressure and contributes to hypertension (Anderson, 1992).

Autonomic dufunction is believed to be a major contributor in cause and sustain of HTN (Malliani, 1991; Brook, 2000). It has been demonstrated in many clinical experiments that hypertensive patients exhibit sympathetic overdrive and reduced vegal tone (Julius, 1993). Furthermore autonomic dysfucntion is directly involved in complications of hypertension (Mancia, 1999).

A study by Julius and Esler found decrease in heart rate and blood pressure following autonomic blockade in hypertensive persons suggestive of increased sympathetic activity in hypertensive patients (Julius, 1975). Another study by Anderson, found an increased muscle

sympathetic nerve activity in subjects with borderline hypertension compared to normotensives and it is independent of salt intake (Anderson, 1989). One of the indicators of increased sympathetic activity in hypertension is decreasedbaroreflex sensitivityand chemoreflex pathways at both peripheral and central levels.

Figure 2: Autonomic imbalance in hypertension



1.5.1 Baroreflex sensitivity (BRS)

BRSis one among the indicators of cardiac autonomic activity and it is frequently used as an indicator of cardiac autonomic functioning (Friedman, 1998). BRS is an index of responsiveness of cardiovascular system to the change in the blood pressure. It indicates the vagal modulation of heart by arterial baroreflex sensitivity (Virtanan, 2003). Low BRS is associated with increased risk of cardiac mortality (Rovere, 1998).Reduced BRS in one of the mechanisms in autonomic dysfunction involved in HTN(Radealli, 1994).

A study by Bajko, found lower baroreflex sensitivity in hypertensive patients compared to normal individuals suggestive of abnormalilty in autonomic functioning (Bhajko, 2012). Impairment in BRS is associated with increased 24hr blood pressure which is direct contributor to the end organ damage in hypertensive patients (Mancia, 2000). Some scientific studies have shown that arterial baroreceptors are reset to a higher pressure in hypertensive patients, and this peripheral resetting reverts to normal when arterial pressure is normalized.

Furthermore, there is central resetting of the aortic baroreflex in hypertensive patients, resulting in suppression of sympathetic inhibition after activation of aortic baroreceptor nerves (Heusser, 2010).

1.5.2 Peripheral vascaulr resistance:

Peripheral vascular resistance is the systemic resistance offered by blood vessel to the blood circulation. Peripheral vascular resistance and cardiac output are responsible for blood pressure. Evidences from several studies have confirmed the strong association of hypertension with increased peripheral vascular resistance (Mulvani, 1977). Patients with hypertension have increased peripheral vascular resistance compared to normotensives, whereas cardiac output and stroke volume may remain normal with increased heart rate (Lund, 1994).A study by Caliva, found increased peripheral resistance in toe blood vessels in hypertensive patients but not in normotensives (Caliva, 1959). The increase in peripheral vascular resistance is also an indicator of increased sympathetic activity (Stamler, 1994).

Decrease baroreflex sensitivity and increased total peripheral resistance is the indicator of elevated sympathetic activity and reduced parasympathetic tone in hypertensive persons (Levin, 1982; La Rower, 1992).

1.6 Hypertension and cognitive function

Hypertension being a systematic disease that affects various organs including heart, brain eyes, kidney, lungs etc. It affects the brain by promotes the atherosclerosis in cerebral arteries causing decrease blood & nutrient supply to deep cerebral tissues this leads to cerebral hypo-perfusion causingimpairment in various brain functions including cognition(Ramirez-moreno, 2016; Swan, 1998). Several cross-sectional and longitudinal studies have confirmed the strong association of hypertension with cognitive decline and increased risk of dementia (Stoog, 2003; Goldman, 1997; Spieth; Van, 1997). In a study by Martin showed a low information processing speed (by DLST) in hypertensive subjects compared to normotensives (Van, 1997). Further, midlife hypertension is known to be responsible for poor cognition and increased risk of development of dementia in later age of life (Gottsman, 2014).

Memory, attention, and processing speed are the common cognitive fucntions that are affected in hypertension (Elias, 1989; Schutze, 1981). A longitudinal study 20-30 years by Swan et al, 1998 showed that individual who had persistent high BP had increased risk of cognitive decline (n=717) compared to normotensives. Another study by Elis et al, 2004, 19 years of follow up found that high level of baseline BP was associated with increased risk of cognitive decline (n=529) (Elias,2004). Kuo et al 2005 in 2802 hypertensive elderly subjects 3 years follow up showed more rapid cognitive decline over a time (Kuo, 2005).

A 14 years follow-up study Knopman et al, 2009 in 1130 hypertensive subjects showed that hypertension is associated with cognitive decline (Knopman, 2009).

Further HTN is a most common risk factor for stroke and vascular dementia (Starr, 1992; Launer, 1995).

Further, hypertensive individuals are at high riskof Alzheimer's disease and vascular dementia (Kivipelto, 2001).Optimal blood pressure control shown to reduces the risk of Alzheimer's disease and generalized neurodegenerative changes responsible for cognitive impairment in

hypertension (Forrete, 1998).Underline pathology of cognitive decline in hypertension is damage of cerebral blood vessels and contributes to the narrowing of lumens of arteries and arterioles that nourish deep tissues in the brain due to hypertension. This process accelerates the development of atherosclerotic plaques in the cerebral blood vessels contributing to increased chances of cognitive decline (Skoog, 1996).

1.7 Hypertension and psychopathologies

Emotions significantly influence the physiological functionssuch as heart rate, blood pressure, heart rate variability, metabolism, hormone secretion from endocrine glands etc (Gentry, 1982; Brooscot, 2003; McCraty, 1995; Thayer, 2010).Prolonged experience of emotions like anxiety, anger, depression, etc.is found to be significant associated with many chronic ailments like, coronary artery disease, diabetes, hypertension, migraine etc. (Kubzansky, 2010; Grass, 1997).Stress, anxiety, depression and hostility are considered to be the common risk factors of cardiovascular disease (Rosengren, 2001).Among psychological factors anger, anxiety and depression are predominantly associated with hypertension (Jonas, 1997;Friedman, 2001).

Anxiety increases the sympathetic activity through activation of HPA axis causing sustained high blood pressure & hypertension (Player, 2010). In retrospective study higher rates of hypertension was found in patients with anxiety disorder compared to general population (Caroll, 2010). A study found pre-pregnancy existence of anxiety and depression is associated with pregnancy induced hypertension (Thombre, 2015).A study by Wei found that 12% of hypertensive subjects suffer from anxiety (Wei, 2006).Elevated anxiety in hypertension increases the progression of atherosclerosis (Paterniti, 2010).In another study in Danish people it was found that patients with anxiety disorder had increased rates of hypertension than normal individuals (Johannessen, 2006). A 5 years follow up study showed CAD patients

who underwent coronary intervention and who had higher anxiety level showed increased risk of revascularization compared those who had lower anxiety (Meyer, 2015).In a follow up study on 726 subjects (healthy at baseline) showed that sustained increased anxiety levels were associated with progression if atherosclerosis measured by carotid artery thickness over 4 years (Paterniti, 2001). Women with liable anxiety are known to have increased blood pressure and increased risk of cardiac disease (Winkel, 2014).

Apart from anxiety, depression is also involved in development, maintenance and complication of the hypertension (Rutledge, 2002).

Depression is a major mental health problem and leading cause of disability. It is a most commonly observed in one of the independent risk factor for ischemic heart disease (Son, 1997; Strine, 2008).Depression is associated with increased prevalence of hypertension (Nagawar, 1987; Adamis, 2000). Person with hypertension have elevated depression compared to healthy subjects (Scherrer, 2003). During depression episode blood pressure rises and come down during remission (Friedman, 1977). Maurice also found positive correlation between depression and blood pressure. A meta-analysis by Meng et al found depression as a risk factor for hypertension based on 9 prospective studies in 22 367 participants(Meng, 2012).Another A meta-analysis found 42% increased risk of hypertension in depression (Meng, 2012).A 7-16 years follow up study reported that anxiety and depression are independent risk factors for hypertension (Jonas, 1996).

Depression lead to several behavioral changes such as smoking, alcohol, reduced physical activity etc. which are considered as risk for hypertension and CVD (Allan, 2007; De Moor. 2008; Appleton. 2007; Strine, 2008).In a survey in 4,913, middle aged found that 44% of individuals with depression baseline were found to have higher chances of developing hypertension (Gangawische, 2010). A meta-analysis showed that depression is an independent risk factor for cardiovascular diseases (Van der kooy, 2010).

In a cross-sectional study it was found that patients with hypertension have higher chances of developing depression than normotensives (Brosworth, 2003).

In a studyanxiety and depression were assessed in 276 who have ever told that they had hypertension and 2992 persons who have never told, among these persons who have been told that they had hypertension had more anxiety and depression than who had been not told (Monk, 1981). Another study showed a high rate of incident hypertension in subjects with high level of depression and anxiety (Jonas, 1996).

A Strong association was observed between presentation hypertension and anxiety disorder and major depressive disorder in US veterans (Carroll, 2010).

Higher depressive symptoms not only increase the risk of development and coronary artery disease (CVD) but also it worsens the existing CAD (J.P.van Malle, 2004).

1.8 Need of alternative & complementary medicine

HTN is a chronic health condition and a leading cause of morbidity and mortality affecting large population across the globe. It is major cause of annual death and an independent risk factor for several serious complications such as cardiac complications, renal complication, and stroke etc. Cause of the HTN includes complex interaction between genes and environmental factors. Hypertension is characterized by autonomic dysfunction and increased anxiety and depression.

Present conventional medication have limited role in management of HTN. Antihypertensive medication helps in reducing the blood pressure but they do not correct the autonomic imbalance in hypertension also conventional management of hypertension doesn't include psychological intervention to minimize anxiety and depression, anger etc. which are strongly involved in maintenance of HTN.

Despite of variety of group of anti-hypertensive drugs, there is no definite cure for hypertension in present conventional medicine. Conventional medicine reduces the blood pressure but no effect of autonomic imbalance, emotional triggers of blood pressure. Hence, there is a need of alternative and complementary medicine in prevention, management and treatments of HTN.

1.9 Need of the of Yoga

HTN is characterized by elevated blood pressure and autonomic imbalance. There is bidirectional association of anxiety, depression and HTN. Anti-hypertensive management should focus not only on mantainance of optimal blood pressure but also to maintain autonomic balance and optimal mental health.

Yoga being a mind body intervention shown to be an effective intervention on several physiological, physical and psychological domains. Growing evidences showed a potential use of yoga in several chronic health conditions including cardiovascular disease. Practice of yoga has beneficial effects on cardiac fitness. There is evidence for improvement in blood pressure and cardiac risk factors following yoga in hypertensive patients.

Hence yoga can be a comprehensive intervention to reduces blood pressure along with improving mental health and autonomic balance in HTN

1.10 Yoga

Yoga is an art and science of healthy living. Thousands of year ago yoga originated in India, and in present day yoga has been a proven method to improve health and management of disease (Sengupta, 2012).The term ‘yoga’ is derived from the Sanskrit rot ‘yuj’, meaning ‘to join’ or ‘to yoke’ or ‘to unit’. According to yogic scriptures the practising yoga it unites the individual soul to that of universal soul, indicating perfect harmony between the mind and

body, man and nature. Yoga may improves strength and flexibility, and it may help to regulate physiological variables like blood pressure, respiration and heart rate, and metabolic rate to improve overall exercise capacity (Raub, 2002). Yogic practice improves strength of muscles and bring out the flexibility of body, improves respiratory cycle heart function, it also reduces stress, chronic pain and improve sleep pattern, and enhance overall wellbeing (Woodyard, 2011). Yoga based life style programs are effective in reducing blood pressure and beneficial effects in the subjects with Hypertension among Diabetic Patients (Field, Diego, Delgado, &Medina, 2013).Yoga, a magnificent inheritance commands a strong and benevolent presence in this world. Yoga is a way of life an integrated system of education for mind, body and spirit. This art was perfected and practiced in India thousands of years ago. Many have responded to call of yoga in recent times and reaped diverse benefits in terms of enhancement of quality of life.

HTN is one of the most prevalent and leading cause of mortality (S.S.Lim,2012), characterized by chronic persistent elevated blood pressure. It a major public health problem affecting more than one billion people around the world. Hypertension contributes to thirteen percent of deaths/years (WHO, 2002).

1.11 IAYT

Integrated approach of yoga therapy (IAYT) is a residential yoga based lifestyle intervention at SVYASA University, Bangalore, India. IAYT is having more than 40 years of history of treating various kinds of health issues. In this program chronic health issues such as diabetes, arthritis, chronic back pain, heart disease, and hypertension were treated. This residential set up consist of different types of department like yoga departments of endocrine and metabolic disorders, department of spinal disorders, department of neurological disorders, department of hypertension and heart disease etc. Along with yoga practices IAYT includes other aspects of

lifestyle like disease specific diet, counselling session, devotional sessions, tuning to nature, happy assembling (Nagarathna, & Nagendra, 2010).

1.11.1 Concept of IYT

Theory of IAYT is based on ancient yoga texts such as Bhagvat gita, Yoga Vashistha, Upanishads and Patanjali yoga sutras. According to these texts every individual consciousness existence into five different layers of consciousness called Panchkoshas. They are

1. Annamaya koshas (physical body)
2. Pranamaya kosha (Vita body)
3. Manomaya kosha (Mind)
4. Vijnanamaya kosha (Intellect)
5. Anandamayakosha (Astral body or causal body)

Any kind of psychosomatic problem is result of disturbance in the harmony of first three koshas i.e. Annamayakosha, pranamaya kosha and manomaya kosha. Adhi is disturbed state of mind which leads problems at physical body taking form of psychosomatic disease. IAYT provides the practices at all level of koshas. At annamayakosha- Healthy diet, asanas and kriyas, at pranamayakosha practice of pranayama at manomaya kosha – devotional sessions, meditation, chanting and prayer, at vignanamaya kosha- counsieling and listening to lectures and reading spiritual books also at anandamaya kosha level service and unconditional love.

Considering this idea Several expert from different field including medical field of SVYASA University has developed a IAYT module for psychosomatic diseases. IAYT is a residential program consisted of practices of asana, pranayama, meditation, yoga based relaxation techniques, devotional sessions, counselling and tuning to nature.

1.12 Scientific studies on IAYT

Several scientific investigations on IYT have shown its effects on various health domains in different clinical conditions. In a study by John E, 2010 reported a significant decrease inwalking pain, range of knee flexion, walking time, tenderness, swelling, and knee disability reducing pain (Ebnezar, Nagarathna, Yogitha, & Nagendra, 2012), morning stiffness, anxiety, blood pressure and pulse rate in patients with OA knees (Nagarathna, Nagendra, Ebnezar, & Yogitha, 2012). Another study by Padmini T showed a significant decrease in low back pain, anxiety and QoL in subjects with chronic low back pain (Tekur et al., 2012). Another study by Jayanti, 2016 showed a significant improvement in functional constipation following one week of IAYT (Rao, 2016).