CHAPTER I

PURPOSE OF THE STUDY
1. **INTRODUCTION**

Aging is an established cardiovascular (CV) risk factor. Hypertension is becoming an important medical and public health problem all over the world and is found to be one of the common disorders of ageing (Fagard RH., 2002). According to World Health Organization (WHO), the most common cause of preventable death in developed countries is hypertension, which is significantly increasing in developing countries (Ezzati M et al., 2002). Hypertension along with aging is a major risk factor for cardiovascular (CV) morbidity and mortality (Supiano MA., 2009).

There are diverse mechanisms and age-related factors involved in the development of hypertension in older individuals. The major contributing factors and predominant mechanisms that develop hypertension in elderly are vascular stiffness and endothelial dysfunction. Two major age-related structural changes that take place in elastic arteries are stiffness and dilatation. These changes results in decline or failure in expansion of aorta in response to ventricular systole which leads to elevation in systolic blood pressure (SBP) (isolated systolic hypertension) and failure to recoil leads to decrease in diastolic blood pressure (DBP) thus causing widening of pulse pressure (PP). Hence, PP is a best tool for measuring vascular aging and a good marker for CV risk in elderly. Pulse pressure is an independent indicator of arterial stiffness. Another factor related to arterial stiffness that elevates SBP in elderly is early arrival of wave reflection during systole (Lim MA & Townsend RR., 2009; Laurent S & Boutouyrie P., 2007; Ghiadoni L et al., 2009). PP, a pulsatile component of blood pressure is more closely associated to CV events than SBP or DBP alone (Franklin SS et al., 2001). A meta-analysis of several studies with data of 8,000 elderly patients found that a 10mmHg increase in PP increased the risk of major CV complications and mortality by nearly 20% (Blacher J et al, 2000).

Arterial stiffness is an independent and strong predictor of CV morbidity and mortality in hypertensive without any overt CV disease (Blacher J et al., 1999; Laurent S et al., 2001) and also in well-functioning older adults (Sutton-Tyrrell K et al., 2005). Studies have shown a positive correlation between PP and arterial stiffness (Safar ME., 2000; Safar ME et al., 2003; Cecelja M et al 2009). Pulse wave velocity (PWV), augmentation index (AIx) and arterial stiffness index (ASI) are recommended measures of arterial stiffness.
PWV is a measure of regional arterial stiffness. An increase in PWV indicates an increase in arterial stiffness or decrease in vascular compliance. AIx is a measure of wave reflection which elevates with an increase in arterial stiffness (Laurent S et al., 2006).

The age-related endothelial dysfunction associated with decreased bioavailability of nitric oxide (NO), a potent vasodilator, contributes to vascular stiffness and hypertension (Jin RC et al., 2010). Oxidative stress is also implicated in the development of hypertension. Increased vascular oxidative stress damage the endothelium causing reduction in NO production and its bioavailability which leads to impairment in endothelium-dependent vasodilation with resultant enhanced vascular tone and hypertension (Briones AM., et al 2010; Schultz E et al., 2011). Other age-related physiological changes that contribute to hypertension in elderly are increased sympathetic activity, decreased baroreceptor sensitivity, decreased alpha- and beta adrenergic receptor responsiveness and low plasma renin activity (Supiano MA., 2009).

As the elderly individuals suffering from isolated systolic hypertension are often resistant to pharmacological treatment, so any attempt to reduce the SBP aggressively lowers DBP (decreased with age) to such an extent to compromise coronary blood flow (Calhoun DA et al., 2008; Vongpatanasin W., 2014; Satoshkar RS et al., 2005). Moreover, it has also been reported that arterial stiffness increases at a faster rate even in treated hypertensives with well controlled blood pressure (BP) than in a normotensives (Benetos A et al., 2002). These findings necessitate an alternative approach that controls hypertension along with the progression of arterial stiffness with age in order to prevent the CV mortality and morbidity.

Among the life-style modalities, yoga has been known to have established health benefits. We have found a significant reduction in SBP and PP following yoga practice for 6 weeks in elderly subjects with Grade-I hypertension in a preliminary study (Patil SG et al., 2014). But, the exact underlying mechanism of benefit remains unknown. Therefore, we aimed to determine the effect of yoga on vascular function in elderly with increased pulse pressure and to explore the benefits of mechanism of yoga on hypertension.
2. OBJECTIVES OF THE STUDY

The objectives of the study in elderly individuals with increased pulse pressure are as follows:

i. To determine whether there is any significant effect of yoga on vascular compliance or arterial stiffness.

ii. To determine whether there is any significant effect of yoga on endothelial function.

iii. To determine whether yoga training can significantly modulate autonomic activity.

iv. To determine whether there is any significant effect of yoga on oxidative stress and antioxidant defense.

v. To explore the possible yoga induced mechanism of control of BP in elderly.
3. HYPOTHESIS

a. H0: Null Hypothesis
i. There will be no statistically significant difference in vascular compliance or arterial stiffness before and after yoga.
ii. There will be no statistically significant difference in endothelial function before and after yoga.
iii. There will be no significant beneficial alteration in the activity of cardiac autonomic nervous system following yoga practice.
iv. There will be no statistically significant difference in oxidative stress and antioxidant defense before and after yoga.
v. There will be no statistically significant difference between effects of yoga and walking on vascular stiffness, cardiac autonomic nervous system activity, oxidative stress and antioxidant capacity.

b. H1: Alternate hypothesis
i. Yoga training will lead to increase in vascular compliance or decrease in arterial stiffness,
ii. Yoga training will lead to improvement in endothelial function.
iii. Yoga practice will lead to decrease in sympathetic activity, increase in parasympathetic dominance and balance the sympathovagal balance.
iv. Yoga practice will lead to decrease in oxidative stress and increase in antioxidant defense.
v. Yoga intervention will be more effective than walking on vascular stiffness, endothelial function, cardiac autonomic nervous system activity, oxidative stress and antioxidant capacity.
Chapter I

Purpose of the study

4. REFERENCES

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