

To Study the Effect of Sudarshan Kriya Yoga and Conventional Physical Exercise on Blood Pressure, Pulse Rate and Quality of Life in Prehypertensive Subjects

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Abstract:

Adoption of healthy lifestyle by using Sudarshan kriya yoga, meditation and physical exercise interventions in the early course of development of hypertension i.e. in prehypertension stage is useful to prevent emergence of hypertensive cases and improvement of their quality of life. A randomized controlled trial was performed to assess the effect of Sudarshan Kriya Yoga (SKY) and Physical Exercise (PE) on SBP, DBP, PR and QOL in prehypertensive subjects. In this study 100 prehypertensive subjects of either gender, age group (30-60 years) were divided into SKY and PE groups having 50 subjects in each group at SP Medical College Bikaner. They were undergone regular practices of SKY and PE respectively, one hour daily for the duration of three months. Statistically significant decrease was noted in SBP, DBP, PR and improved QOL score ($p < 0.001$) after three months of regular SKY practices. Physical exercise performed was brisk walking which after three months showed statistically significant decrease in SBP, DBP and PR along with improvement in QOL of the participants. SKY and PE interventions have resulted in decreased blood pressure and pulse rate along with improved quality of life. This is indicative of autonomic nervous system balance with increased parasympathetic activity, sympathetic inhibition and improvement of many systemic functions so they can be applied as a mass approach for prevention & control of hypertension and improvement of quality of life.

Keywords: Sudarshan Kriya Yoga (SKY), Physical Exercise (PE), Prehypertension, Systolic blood pressure (SBP), Diastolic blood pressure (DBP), Pulse rate (PR), Hypertension, Quality of Life (QOL).

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Introduction

Hypertension is a major global health issue, impacting more than a billion individuals and leading to around 9.4 million deaths each year. It greatly raises the risk of the cardiovascular based issues such as the coronary heart disease and more. [1]

Rapidly increasing cases of high blood pressure may alter the overall disease burden, potentially making cardiac diseases the leading causes of resulting death worldwide by the year 2025. [2]

Adults with blood pressure readings of 120-139 mmHg systolic and 80-89 mmHg diastolic fall into the pre-hypertension category. Being pre-hypertensive increases the likelihood of developing hypertension and cardiovascular diseases, making it crucial to control and lower blood pressure. [3]

The new classification system designates individuals with systolic blood pressure of 120-129 mmHg and also the diastolic pressure which is below 80 mmHg as having the elevated blood pressure, while those with systolic pressure of 130-139 mmHg and diastolic pressure of 80-89 mmHg are classified as having hypertension stage 1; previously, such individuals were considered prehypertensive. [1,3]

The quality of life is assessed by using, the WHOQOL-BREF which is a shortened version of the WHOQOL-100. It evaluates four domains: physical health, psychological health, social relationships and environmental health, along with facets on overall quality of life and general health. With 26 items, it covers various aspects of well-being, with scores ranging from 1 to 5. [4,5]

Sudarshan Kriya Yoga is an ancient rhythmic breathing technique based on vedic tradition. It is designed and recommended by H. H. Sri Sri Ravishankar ji founder of art of living. It is a complete package of yoga including pranayama, physical postures, meditation, and spiritual knowledge. Along with holistic approach it is said that yogic practices have many effects which are beneficial in prevention as well as the management of the stress, anxiety, quality of the life and other psychosomatic diseases. [6]

After Prime Minister Mr. Narendra Modi proposed yoga at the “United Nations General Assembly on December 11, 2014”, the UN adopted it, with support from member states to promote yoga globally. This was a positive step for global health. The first International Yoga Day was celebrated in Delhi on June 21, 2015. Ever since, June 21 has been marked as “International Yoga Day” globally, aiming to raise awareness about the manifold benefits of these age-old practices within communities worldwide. [7]

Physical exercise involves increased energy expenditure by skeletal muscles. Regular brisk walking, defined as “walking at a pace of three miles per hour or 20 minutes per mile, for 30 minutes” has significant health benefits compared to a sedentary lifestyle. The usually recommended duration of exercise is 30-60 minutes. [8]

Lifestyle interventions, including regular physical activity, have proven to be beneficial in improving the quality of life for participants. By incorporating exercise into daily routines, individuals can effectively manage their health conditions, enhance

overall well-being, and enjoy the better quality of the life. [9]

Material and Methods

In this study 100 participants aged 30-60 with prehypertension were enrolled. They were divided into two groups SKY (Sudarshan Kriya Yoga) and PE (physical exercise) each comprising 50 individuals, they were instructed to engage in their respective activities for one hour daily over three months. SKY involved yoga practice, while PE included a regimen of “slow walking warm-up, brisk walking, and cool down”. Conducted at the Department of Physiology, S.P. Medical College, Bikaner, from December 2017 to March 2023 with informed consent, the study aimed to assess the effects of these interventions on health parameters. The ethical approval for the study was obtained from the human ethical committee of S.P. Medical College, Bikaner. Before starting the intervention baseline parameters (i.e. SBP, DBP, PR and QOL) were recorded for all the study subjects, three months after completion of study period the same set of parameters was repeated. All the subjects participated voluntarily in the study. The patients suffering from coronary artery disease, diabetes mellitus, Pulmonary tuberculosis, asthma, any other major illness and non-cooperative subjects were excluded from the study.

Results

Statistically highly significant results of SKY were obtained in SBP, DBP, PR and QOL in prehypertensive subjects. Statistically highly significant results of PE also, were obtained in SBP, DBP, PR and QOL in prehypertensive subjects.

Table 1: Distribution of cases according to age group

Age Group (years)	Pre HTN				Total	
	Yoga		PE		No.	%
	No.	%	No.	%		
34-40	23	46.0	14	28.0	37	37.0
41-50	19	38.0	21	42.0	40	40.0
>50	8	16.0	15	30.0	23	23.0
Total	50		50		100	
Mean	43.02		45.36			
SD	7.24		6.24			
t	1.732					
p	0.086					

Table 2: Distribution of cases according to gender

Gender	Pre HTN				Total	
	Yoga		PE		No.	%
	No.	%	No.	%		
Female	11	22.0	11	22.0	22	22.0
Male	39	78.0	39	78.0	78	78.0
Total	50		50		100	
χ^2	-					
p	-					

Table 3: Statistical analysis of SBP, DBP and PR between pre and post treatment in pre-hypertensive in SKY group

Parameters	Pre-Treatment		Post Treatment		t	p
	Mean	SD	Mean	SD		
Systolic BP	133.20	4.06	122.44	3.13	20.318	<0.001
Diastolic BP	84.48	2.30	76.96	2.29	18.508	<0.001
Pulse Rate	89.58	5.79	80.52	5.26	7.065	<0.001

Table 4: Statistical analysis of QOL between pre and post treatment in pre-hypertensive SKY group

DOM	PreTreatment		Post Treatment		t	p
	Mean	SD	Mean	SD		
DOM-1	42.82	12.38	73.48	11.33	23.962	<0.001
DOM-2	43.36	11.85	72.06	11.05	20.872	<0.001
DOM-3	42.72	13.06	70.06	11.22	26.782	<0.001
DOM-4	42.88	12.00	70.78	13.35	24.682	<0.001

Table 5: Statistical analysis of SBP, DBP and PR between pre and post treatment in pre-hypertensive PE group

Parameters	Pre-Treatment		Post Treatment		t	p
	Mean	SD	Mean	SD		
Systolic BP	133.40	3.48	129.40	3.48	11.832	<0.001
Diastolic BP	84.56	2.10	81.32	2.54	20.186	<0.001
Pulse Rate	90.48	5.22	80.60	4.89	16.473	<0.001

Table 6: Statistical analysis of QOL between pre and post treatment in pre-hypertensive PE group

DOM	PreTreatment		Post Treatment		t	p
	Mean	SD	Mean	SD		
DOM-1	41.22	10.86	55.36	10.27	18.267	<0.001
DOM-2	40.72	9.79	48.28	9.14	20.284	<0.001
DOM-3	39.70	12.06	48.74	11.81	8.624	<0.001
DOM-4	39.20	10.00	45.62	9.52	18.527	<0.001

Discussion

Blood pressure is one of the most important cardiovascular health parameters. Patients of hypertension are increasing more and more particularly in the developing country like India. In alternative medicine there are a number of regimes like herbal, dietary supplements and mind body interventions to control blood pressure. Yoga meditation and physical exercise are also preferred by many people as lifestyle modification measure to control their blood pressure and living with a healthy lifestyle. SKY and PE have been found effective to decrease the blood pressure, pulse rate along with improved quality of life. The proposed hypothesis and underlying mechanisms of these interventions are multifaceted. The influences of Sudarshan Kriya Yoga (SKY) stimulate the vagus nerves, leading to physiological changes in various organs and glands. Additionally, they affect ascending fibers that connect to "thalamic generators, the limbic system, and cortical areas in the brain". This cascade of effects suggests a comprehensive impact of SKY on both the autonomic nervous system and higher brain functions. [10]

During ujjayi breathing, resistive loading triggers afferent input from lung and chest wall structures, stimulating the vagal and spinal pathways. These

signals reach the parabrachial nucleus and locus coeruleus, modulating heart rate via increased parasympathetic and decreased sympathetic input to the sinoatrial node, resulting in a decrease in heart rate. [11]

Regular practice of SKY has been observed to alleviate stress, leading to a reduction in the secretion of adrenocorticotrophic hormone (ACTH) and cortisol. As a consequence, the secretion of aldosterone, a potent vasoconstrictor, is decreased. This reduction in aldosterone levels contributes to a decrease in blood pressure. [12,13]

Yogic exercises not only restore normal baroreceptor sensitivity but also alleviate stress-induced sympathetic hyperactivity in patients with essential hypertension (EH). They also influence the secretion of hormones such as renin, angiotensin, adrenaline and vasopressin, which play key roles in blood pressure regulation. [14]

SKY has been observed to decrease oxidative stress by reducing malondialdehyde adducts (MDA), serum urea and free radicals, while simultaneously increasing levels of SOD, catalase, and glutathione peroxidase. These findings suggest that SKY may con-

tribute to improved cardiovascular and renal functions by mitigating oxidative stress and enhancing antioxidant defenses. [15]

The findings of research studies conducted by Woodyard C and Oken BS et al, highlighted the positive impact of yogic practices on muscular strength, flexibility, respiratory and cardiovascular functions, stress reduction, anxiety alleviation, and overall well-being. [16,17]

It has been found effective to cure as well as prevention of many chronic diseases by regular practices of yogic exercises. Yoga improves pattern of sleep, enhance over all wellbeing and quality of life of individuals. [18]

In prehypertensive subjects, PE led to a significant decrease in mean systolic, diastolic blood pressure and pulse rate. These findings are consistent with studies conducted by Kokkins PF et al, which reported significant reductions in blood pressure among mild hypertensive patients following PE intervention. [19]

The underlying mechanisms of action of physical exercise on decreasing blood pressure and preventing hypertension are multifaceted. [20] They include increased endothelial function, enhanced insulin sensitivity, improved baroreceptor sensitivity, activation of the parasympathetic nervous system and reduced sympathetic activity, among others. Additionally, regular physical exercise improves physical fitness, resilience to stress, and brain function, leading to overall improvements in physical and mental health. [21]

Overall, these findings underscore the importance of physical exercise as a lifestyle intervention for managing hypertension. Regular physical exercise not only improves cardiovascular health but also contributes to overall well-being and quality of life. [22] In the review of 56 studies by Gillison *et al* who showed that PE with moderate intensity performed for a duration of 3 to 6 months significantly improved QOL of practitioners in comparison to the control group. [23]

Another scientific study performed by Wei L *et al* also found that regular physical exercises have positive effect on the QOL and other health parameters in the participants. [24]

In the meta-analysis conducted by Atlantis *et al*, which demonstrated significant improvements in QOL with moderate-intensity exercise interventions lasting for 3 to 6 months. [25]

Conclusion

Sudarshan Kriya Yoga and Physical Exercise have their role in decreasing blood pressure level and improved quality of life. They establish balance between the two divisions of autonomic nervous system by parasympathetic dominance and decreased

sympathetic activity. The study may prove to be fruitful in the prevention of emergence of hypertension so that explosive rise in the clinical cases of this silent killer can be kept under control as well as quality of life of individuals can be improved. Further research is needed to know up to what extent SKY and PE can play their role in the management of hypertension and other lifestyle diseases.

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