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**Dr. Chandrakanta Mishra**  
Associate Professor in  
Cardiology, SCB Medical  
College, Cuttack, Odisha, India

**Dr. Archana Mishra**  
Associate Professor in  
Physiology, SCB Medical  
College, Cuttack, Odisha, India

**Eshaan Mishra**  
MBBS student, SCB Medical  
College, Cuttack, Odisha, India

## Original Research Article

# Effect of Sudarshan Kriya yoga on prehypertension and stage 1 hypertension

**Dr. Chandrakanta Mishra, Dr. Archana Mishra, and Eshaan Mishra**

### Abstract

Hypertension is popularly called as 'Silent Killer' with prevalence of 29.8% in India. Hypertension is directly responsible for 57% of all stroke deaths and 24% of all coronary heart disease deaths in India. Due to varying patient response to different anti-hypertensives, as monotherapy or combination, their efficacy, tolerance, compliance, complication rates and severity, the need for assessment of effectiveness of complimentary and alternative therapeutic modalities arises. Sudarshan Kriya is a systematically structured sequence of asanas, pranayams and mindfulness meditation taught by The Art of Living. 72 subjects with Prehypertension and Stage I hypertension, no other associated diseases, were recruited into the study where they were taught Sudarshan Kriya for 5 days and left for daily home practice and follow up sessions every Sunday. Blood pressure was recorded at enrollment, at the end of 6 weeks and 12 weeks. Only 33 subjects were compliant to the procedure and included for data analysis. The mean systolic BP decreased from 139.76mmHg to 132.48 mmHg (6 weeks,  $P<0.001$ ) and then to 129.7 mm Hg (12 weeks,  $P<0.001$ ). The mean diastolic BP decreased from 86.42mmHg to 82.24mmHg (6 weeks,  $P<0.001$ ) and then to 80 mmHg (12 weeks,  $P<0.001$ ). Since the subjects were not on any other modality of treatment, the decline is attributed to proper regular practice of duly initiated and maintained Sudarshan Kriya Yoga. Sudarshan Kriya Yoga is reasonably safe and can be effectively used for treatment of Prehypertension and Stage I hypertension, alone or with an anti-hypertensive drugs as stand-by, as per the discretion of the treating physician.

**Keywords:** Sudarshan Kriya yoga, prehypertension, hypertension

### Introduction

Yoga comes from the Sanskrit word 'yuj' means 'to unite'. Yoga is an ancient Indian way of physical, mental, social and spiritual well-being in tune with the cosmos. Recently yoga has been adopted as an approach to health within Complimentary and Alternative Medicine [1]. Sudarshan Kriya yoga (SKY) is the essence of the Art of Living's "Basic Course" or "Happiness Programme" designed by His Holiness Sri Sri Ravi Shankar.

SKY consists of various cyclical breathing practices in different postures and rhythms which include:

1. "Ujjayi" or "Victorious Breath". It consists of slow rhythmic breathing in three different positions through throat @ about 2-4 breaths / min with end inspiratory and end expiratory holds; ratio of phases per cycle being 4:4:6:2.
2. "Bhastrika" or "Bellows Breath". It consists of 3 phases of rapid maximal inhalation and forceful expiration @ about 30/ min in Vajrasana with corresponding hand movements.
3. Chanting "OM" 3 times as directed.
4. Sudarshan Kriya Breathing which consists of rhythmic cyclical slow, medium and fast breathing cycles.
5. Finally a phase of recovery in sitting and lying postures maintaining mindfulness as directed.

Population- based surveys as well as clinical trials indicate that Yoga s a relatively safe intervention that is not associated with more adverse events than other forms of physical activity. Given the possibility of better risk/ benefit ratio, it may be advisable to focus on yogic meditation and/or breathing techniques [2].

**Corresponding Author**  
**Dr. Archana Mishra**  
Associate Professor in  
Physiology, SCB Medical  
College, Cuttack, Odisha, India

Overall prevalence of hypertension in India is 29.8% (26.7-33). Regional estimate for Urban Eastern India is 34.5% (32.6-36.5) [3]. Hypertension is directly responsible for 57% of all stroke deaths and 24% of all coronary heart disease deaths in India [4]. WHO rates hypertension as one of the most important causes of premature death worldwide [5]. The Global and Regional Burden of Disease and Risk Factors Study (2001) is a systematic analysis of population health data for all attributable deaths and attributable disease burden, has ranked Hypertension in South Asia as second only to child underweight for age [6].

Hypertension is popularly called as 'Silent Killer' as it may be asymptomatic but can progress to a complication. Only method of detection is BP recording. Due to varying patient response to different anti-hypertensives, as monotherapy or combination, their efficacy, tolerance, compliance, complication rates and severity, the need for assessment of effectiveness of Complimentary and Alternative therapeutic modalities arises. Yoga and meditation improve endothelial function in subjects with Coronary Artery Disease [7]. Sudarshan Kriya positively modifies stress coping behavior and initiates appropriate balance in cardiac autonomic tone [8].

### Materials and Methods

This prospective study was conducted in Department of Physiology, SCB Medical College, Cuttack in collaboration with The Art of Living Centre, Johrimall High School, Ganesh Ghat, Cuttack from March 2016 to September 2016 with ethics committee approval. Subjects were recruited from those attending Cardiology OPD of our institute on referral basis. Based on willingness after informed consent subjects (n=72, males=43, females=29 with prehypertension (119mmHg <systolic BP <140mmHg, 79mmHg <diastolic BP <90mmHg), and Stage I hypertension (139mmHg <systolic BP <160mmHg, 89mmHg <diastolic BP <100mmHg), aged between 30-50 years, without anti-hypertensive medication( non-compliant, having adverse drug reaction, unwilling to take allopathic medicines) were included in the study. Subjects with other associated diseases like cancer, heart disease, arthritis, asthma, COPD, epilepsy, tuberculosis, any infectious disease, liver/kidney disease, pregnancy, or BP $\geq$ 160/100 mmHg, were excluded. Also people residing beyond 20kms from the Art of Living Centre were not enrolled.

Resting BP was recorded using manual sphygmomanometer, before starting the intervention. They were taught SKY at Art of Living (AOL) Centre for 5 days

by certified teachers under our supervision. A modified mudra was practiced for Bhastrika as advised by the AOL instructor. Thereafter they were taught Short Kriya for daily home practice and maintenance Long Kriya at the Centre every Sunday. Besides they were advised satvic vegetarian diet, prayers, yogasanas, guided meditations and attitude based on Sri Sri's knowledge points. They were asked to maintain log book recording their daily practice particulars, experience during Kriya and difficulties.

The BP was checked at the end of each day of 5 day course to check for any adversities. Then on follow up Long Kriya sessions at 6 weeks and 12 weeks, resting BP was recorded before the session (To rule out immediate Long Kriya effect which could induce neurohumoral changes altering BP).

Compliance was recorded as self-reported with no incentives for regularity or denial of recordings for non-compliance. The subjects compliant to a minimum of 5 days/week Short Kriya practice with at least a fortnightly Long Kriya follow up were included for analysis. All statistical analysis was done using SPSS software (version 21.0). Paired 't' test was used to test for significance of the quantitative parameters. P value < 0.05 was considered statistically significant.

### Result

Though 72 subjects were recruited for the study, only 33 were included in analysis due to our strict adherence to compliance for inclusion in analysis (Table I). More number and percentage of drop out were females. The commonest reason for drop out or non-compliance as stated by the subjects was 'work pressure' followed by 'difficult/ long procedure'. Number of drop outs is more in first 6 weeks. There were no adverse reactions in any of the enrolled subjects (n=72). Also the weekly follow up Long Kriya sessions were sans any adverse effects.

Table II shows the mean systolic blood pressure(SBP) was 139.76mmHg at baseline which showed a decline of about 7.3 mmHg at 6weeks (mean 132.48 mmHg) and continued the decline by another 2.7mmHg at 12 weeks(mean 129.70mmHg).The mean diastolic blood pressure (DBP) was 86.42 mmHg which showed a decline of about 4.2mmHg at 6weeks (mean 82.24mmHg) and a further decline of 2.2 mmHg at 12 weeks(mean 80 mmHg).The decline at all stages of follow up is statistically very highly significant at all stages (Table III). A greater magnitude of decline has been observed in both SBP and DBP in initial 6 weeks compared to next 6 weeks at follow up.

**Table 1:** Number of participants based on compliance at follow up

Subjects	At Enrollment (n=72)	6 Weeks (n=48)	DO/ NC	12 Weeks (n=33)	DO/NC
Male	43	28	15	20	8
Female	39	20	19	13	6

DO→drop out, NC → non-compliant

**Table 2:** Descriptive statistics of study population (n=33)

	Baseline (Mean± SD)	6 weeks (Mean± SD)	12 weeks (Mean± SD)
SBP in (mmHg)	139.76± 9.162	132.48±9.722	129.70±9.221
DBP in (mmHg)	86.42±4.944	82.24±5.309	80±4.388

SBP= systolic blood pressure, DBP= diastolic blood pressure

**Table 3:** Paired sample tests of study population (n=33)

Pair analysed	Paired Differences				t value	df	P value
	Mean	Std Dev	Std Err	95% CI Lower Upper			
SBP 0wk - SBP 6wk	7.27	5.119	.891	5.46 9.09	8.161	32	0.000
SBP 0wk - SBP12 wk	10.06	5.208	.907	8.21 11.91	11.098	32	0.000
SBP 6wk- SBP12 wk	2.79	2.288	.398	1.98 3.60	7.000	32	0.000
DBP 0wk -DBP 6wk	4.18	1.758	.306	3.56 4.81	13.664	32	0.000
DBP 0wk - DBP12 wk	5.94	2.150	.374	5.18 6.70	15.872	32	0.000
DBP 6 wk- DBP12 wk	1.76	2.278	.397	0.95 2.57	4.432	32	0.000

### Discussion

The main finding of our study is decrease of BP (both systolic and diastolic) by SKY in Stage I hypertensive patients, which showed incremental decline of BP over a follow up period of 12 weeks, without anti-hypertensive medication in a middle aged population.

The mean systolic BP decreased from 139.76mmHg to 132.48 mmHg (6 weeks,  $P < 0.001$ ) and then to 129.7 mmHg (12 weeks,  $P < 0.001$ ). The mean diastolic BP decreased from 86.42mmHg to 82.24mmHg (6 weeks,  $P < 0.001$ ) and then to 80 mmHg (12 weeks,  $P < 0.001$ ). Since the subjects were not on any other modality of treatment, the decline is attributed to proper regular practice of duly initiated and maintained Sudarshan kriya Yoga. Since decline is sustained over follow up, incremental benefits will be derived by persons on regular practice. Our finding is consistent with Narnolia *et al.*, Somawanshi *et al.* [9, 10]. Similar decline in DBP has been observed by Agte *et al.* [11]. We differ in having additional highly significant decline in SBP, which may be attributed to our strict adherence to proper procedure for practice and compliance for inclusion in analysis and also comparatively longer follow up period. Beneficial effects of SKY can be attributed to increased parasympathetic tone and reduced sympathetic drive [9, 10].

None of the study subjects have shown rise in blood pressure or complications of hypertension. No complications or adverse effects have been observed during initial training, home practice or follow up sessions.

In our study, though we have adhered to strict compliance criteria. But the compliance was self-reported. However, no remuneration was given to regular practice and we continued recording BP of the less regular subjects just to encourage them to be truthful regarding practice. The drop outs and non compliants were more in initial phase (mainly due to busy schedule or long/difficult procedure), less in later follow up period due to practiced acceptance of the SKY. Subjects claimed to be enjoying the procedure in later phase of follow up. Also we find incremental benefit on hypertension on follow up.

### Conclusion

Sudarshan Kriya Yoga is reasonably safe and can be effectively used for treatment of prehypertension and Stage I hypertension, alone or with an anti-hypertensive drugs as stand-by, as per the discretion of the treating physician.

### Limitation

- 1) Further follow up of the study population to see if normal blood pressure can be attained and sustained.
- 2) Larger sample size required to separately study the effect of SKY on prehypertension and hypertension.

### Recommendation

Sudarshan Kriya should be learnt from and practiced under guidance of Art of Living trained teachers. Regular and proper practice is the key to health benefits.

**Conflict of interest:** None.

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