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Original Research Article

Can the sudarshan kriya yoga have any effect on sympathetic function test in pre-hypertensive patient?

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Abstract: Sudarshan Kriyas is known to eliminate stress, fatigue and negative emotions such as anger, frustration and depression, leaving you calm yet energized, focused yet relaxed. This study evaluated the effects of sudarshan Kriya on autonomic sympathetic variable in pre-hypertensive subjects. In present study two groups each having 35 subjects one is pre-hypertensive and one is normotensive were selected between ages 25-75 years of either sex were studied in the morning hours. The patients of pre-hypertension were randomly selected reporting to department of Medicine / Cardiology PBM Hospital, Bikaner. Study group were asked to do Sudarshan Kriya Yoga for three months after proper training under the supervision of expert at The Art of Living Centre Rani Bazar, Bikaner. This study was conducted in the department of physiology Sardar Patel Medical College, Bikaner. Sympathetic non invasive autonomic function test were performed that is hand grip test and postural change test including resting blood pressure. The results were statistically analysed by applying paired "t" test. After the twelve weeks of sudarshan kriya sympathetic function test like orthostatic variation of blood pressure and hand grip test were statistically significantly lower ($p<0.05$). Reduction was more profound in study group than in control group.
Keywords: Sympathetic functions, Blood pressure, Hand grip test, Sudarshan Kriya.

INTRODUCTION

Health is a dynamic state of complete physical, mental, spiritual and social wellbeing and not merely an absence of disease or infirmity [1]. Rapid alterations of life style within a very short span of time leads to chronic imbalance in both body and mind impending a direct effect on the physiology of mankind.

Nowadays stress is an absolutely inevitable part of life. The term 'stress' was first employed in the 1930's by the endocrinologist – Hans Selye [2]. Stress is "a physical or psychological stimulus that affects both physical and mental health. Stress causes hormonal changes, biochemical changes [3]. various illnesses and psychosomatic diseases. Exposure to chronic stress leads to certain physiological changes in our body resulting in diseased states like hypertension, diabetes, heart attacks, gastrointestinal ulcers, asthma, viral infections, migraine etc. These lifestyle diseases are the outcomes of our wrong patterns of living which can be prevented and corrected only if we want it [4].

SUDARSHAN KRIYA YOGA

Sudarshan Kriya Yoga (su = proper, darshan = vision, kriya = purifying action) is a unique rhythmical breathing technique, based on ancient Vedic tradition [5]. It is a special package of yoga, meditation and pranayam with "Sudarshan Kriya" introduced by H. H. Sri Sri Ravishankarji [6].

Sudarshan Kriya

The Sudarshan Kriya is a rhythmical cyclical controlled breathing process with roots in traditional yoga. It has four distinct components [7]. It consists of slow, medium, and fast cycles of breathing practiced for a total duration of 35 minutes without any relaxation in between. At the end a person is asked to remain in yoga nidra (tranquil state) for about 10 minutes.

The four main SKY breathing techniques are as follows [8]

1. Ujjayi or "Victorious Breath" is sometimes called "Ocean Breath" because the sound created by the gentle contraction of the laryngeal muscles and partial closure of the

glottis is reminiscent of the sound of the sea. This slow breath technique (2 to 4 breaths per minute) increases airway resistance during inspiration and expiration and controls airflow so that each phase of the breath cycle can be prolonged to an exact count. The subjective experience is physical and mental calmness with alertness.

2. During Bhastrika or "Bellows Breath" air is rapidly inhaled and forcefully exhaled at a rate of 30 breaths per minute. It engenders excitation followed by calmness.
3. "Om" is chanted three times with very prolonged expiration.
4. Sudarshan Kriya or "Proper Vision by Purifying Action" is an advanced form of cyclical breathing at varying rates—slow, medium, and fast.

Sudarshan Kriya technique oxygenates the cells and rapidly flushes out impurities. Physically, the cells are vitalized; emotionally, one feels a sense of balance and contentment.

MATERIAL AND METHOD

Sample size:

In present study two groups each having 35 subjects one is pre-hypertensive and one is control group were selected between age 25-75 years of either sex were studied in the morning hours. The patients of pre-hypertension were randomly selected reporting to department of Medicine / Cardiology PBM Hospital, Bikaner.

Subjects who are pre-hypertensive according to WHO guidelines were examined for the cardiovascular autonomic. Study group and control group were asked to do Sudarshan Kriya Yoga for three months after proper training under the supervision of expert at The Art of Living Centre Rani Bazar, Bikaner. This study was conducted in the department of physiology Sardar Patel Medical College, Bikaner.

Controls:

Age-matched normotesive (N=35) were examined for the control values of the cardiovascular autonomic functions.

Exclusion criteria:

1. Patients suffering for diabetes mellitus, pulmonary tuberculosis, asthma, chronic bronchitis and no other allergic condition.
2. Absence of any major psychiatric illness. They should not be on any medication of mental illness

Evaluations:

The following tests were performed for assessment of sympathetic activity

Resting blood pressure

Blood pressure was recorded with standard sphygmomanometer by auscultatory method. Before recording the blood pressure, subjects were allowed to rest for 5 minutes in a quiet room to reduce the anxiety. The onset of sounds (kortkff's phase 1) was taken as indicative of systolic blood pressure and disappearance of sound (kortkoff's phase 5) as indicative of diastolic blood pressure.

Lying to standing test (LST)

The subject was asked to rest in a supine position for 5 minutes. The resting BP was recorded. The subject was then asked to stand unaided and remain standing unsupported for 3 minutes. The BP was recorded at 30 seconds and 3 minutes after standing up. The difference between the resting and standing BP levels was calculated.

The fall in systolic BP at 30 seconds on standing noted. A fall of 30 mm Hg or more was defined as abnormal, fall between 11-29 mm Hg as borderline and fall of 10 mm Hg or less was considered normal.

Isometric handgrip test (HGT)

In this test, sustained muscle contraction is measured by a handgrip dynamometer, causes a rise in systolic and diastolic blood pressure and heart rate. The dynamometer is first squeezed to isometric maximum, and then held at 30% maximum for 5 min. if possible, although even 3 minutes may be adequate. Blood pressure was recorded in the non exercising arm thrice at 1-minute interval during the procedure. The maximum reading of the diastolic blood pressure was taken as the final value. Then the rise in diastolic blood pressure was calculated by subtracting resting diastolic blood pressure from this value. A rise in DBP of less than 10 mm Hg was defined as abnormal, 11-15 mm Hg as borderline and 16 mm Hg or more as normal.

Analysis of Observations:

Analysis was done by statistical analysis. Students't' test (two tailed) has been used to find the significance. P=0.05 was considered as statistically significant.

RESULTS

Table 1: Mean age of subjects under study

	Female		Male		Total	
	control	study	control	study	control	Study
Mean	67.51	62.36	63.71	68.50	63.15	61.53
S.D	5.43	8.75	6.65	9.12	7.55	8.88

Table 2: Anthropometric and Sympathetic reactivity test in Control Group in Male

Parameters		Pre- Intervention	Post Intervention	p
		Mean±SD	Mean±SD	
BMI (kg/m^2)		26.21±3.76	26.10±0.143	0.867
Blood Pressure (mmHg)	Systolic	118.24±7.97	115.72±8.84	0.391
	Diastolic	79.12±7.56	77.92±6.11	0.114
Sympathetic Reactivity Test	LST	6.043±2.65	6.07±0.05	0.0008
	HGT	14.06±2.00	10.31±2.33	0.0007

Table 3: Anthropometric and Sympathetic reactivity test in Control Group in Female

Parameters		Pre- Intervention	Post Intervention	P
		Mean±SD	Mean±SD	
BMI (kg/m^2)		24.21±3.12	22.11±0.113	0.865
Blood Pressure (mmHg)	Systolic	110.42±11.65	108.72±8.84	0.391
	Diastolic	73.04±5.99	70.92±6.11	0.134
Sympathetic Reactivity Test	LST	6.04±2.45	6.01±0.04	0.0006
	HGT	13.60±2.47	10.02±2.13	0.0007

Table 4: Anthropometric and Sympathetic reactivity test in study group in Male

Parameters		Pre- Intervention	Post Intervention	P
		Mean±SD	Mean±SD	
BMI (kg/m^2)		28.34±4.16	24.13±1.102	0.734
Blood Pressure (mmHg)	Systolic	131.42±11.65	128.72±9.84	0.491
	Diastolic	87.04±5.99	80.92±4.11	0.234
Sympathetic Reactivity Test	LST	6.77±2.35	6.01±0.06	0.0008
	HGT	14.60±3.11	10.04±2.13	0.0007

Table 5: Anthropometric and Sympathetic Reactivity test in study group (Pre-Hypertensive) in Female

Parameters		Pre- Intervention	Post Intervention	p
		Mean±SD	Mean±SD	
BMI (kg/m^2)		26.11±3.56	22.19±1.01	0.784
Blood Pressure (mmHg)	Systolic	129.42±10.65	122.72±8.17	0.511
	Diastolic	85.03±6.11	79.92±8.21	0.216
Sympathetic ReactivityTest	LST	6.76±2.32	5.89±0.06	0.0008
	HGT	13.60±3.21	9.04±2.10	0.0009

Table 6: Anthropometric And sympathetic parameters at post-intervention in male group of control and study group

		Control group	Study group	p
		Mean±S.D.	Mean±S.D.	
BMI		26.10±0.14	24.13±1.10	0.867
Blood Pressure in (mm of Hg)	Systolic	115.72±8.84	128.72±9.84	0.391
	Diastolic	77.92±6.11	80.92±4.11	0.114
LST		6.07±0.05	5.89±0.06	0.0001
HGT		10.31±2.33	9.04±2.10	0.01

Table 7: Anthropometric And sympathetic parameters at post-intervention in Female group of control and study group

		Control group	Study group	p
		Mean±SD.	Mean±SD.	
BMI		22.11±0.113	22.19±1.003	0.64
Blood Pressure in (mm of Hg)	Systolic	108.72±8.84	122.72±8.17	0.0001
	Diastolic	70.92±6.11	79.92±8.21	0.0001
LST		6.01±0.043	5.89±0.06	0.0001
HGT		10.02±2.13	9.04±2.10	0.05

The mean age of participants was 63.15±7.55in control group and in study group it was 61.53±8.88 years (mean ± standard deviation) (Table-1)

Data presented in above table 2,3,4,5 shows that orthostatic variation of blood pressure and hand grip test were statistically significantly lower ($p<0.05$), in both the male and female group of study group as compared to the male and female group of controls. In both the group resting blood pressure were lower but not statistically significantly ($p>0.5$).when we compared the Anthropometric and Sympathetic parameters in control and study group at post intervention there is a significant improvement in systolic and diastolic blood pressure of females group while LST and HGT were significantly decrease in both the male and female groups. (Table 6 and 7)

DISCUSSION

Sudarshan Kriya incorporates specific natural rhythms of the breath which harmonize the body, mind and emotions. This unique breathing technique eliminates stress, fatigue and negative emotions such as anger, frustration and depression, leaving you calm yet energized, focused yet relaxed [8].

Tests assessing autonomic function are based on evaluation of the cardiovascular reflexes triggered by performing specific provocative man oeuvres. Stimuli that raise blood pressure responses to orthostatic testing are in a large part a reflection of sympathetic activity. Our findings are consistent to Somwanshi *et al,;* in 2013 who found highly significant improvement in cardio respiratory parameters in healthy subjects after 3 months of Sudarshan Kriya Yoga practices [9].

Effect of SKY in Reducing blood pressure and heart rate:

Sustained stimulation of sympathetic nervous (fights and flight response) system increases blood pressure. It is hypothesized that the different cyclical rhythms of Sudarshan Kriya create a variety of vagal, thalamic and cortical effects. During SKY, a sequence of breathing techniques of different frequencies, intensities, lengths, and with end-inspiratory and end-expiratory holds creates varied stimuli from multiple visceral afferents, sensory receptors, and baro receptors [10].

This influence stimulates vagus nerves which in turn induce physiologic changes in organs, glands, and ascending fibers to thalamic generators, the limbic system and cortial areas [11]. Resistive loading created during ujjayi breathing send afferent input via vagal & spinal sources arising from lung & chest wall structures to parabrachial nucleus (PBN) & locus coeruleus [12] which also receives projections from NTS feeding back through dorsomedial nucleus to vagal efferents which in turn slows heart rate by increasing parasympathetic & decreasing sympathetic input to SA node [10] thus decreasing the heart rate. During prolonged voluntary expiration intra-thoracic pressure increases and blood from the lungs is squeezed into the heart leading to an increase in stroke volume; baro-receptors in carotid sinus experiences more pressure and discharge more. The increased baroreceptor discharge inhibit the tonic discharge of the vasoconstrictor nerves and excites the vagus innervations of the heart producing vasodilatation a drop in systolic blood pressure and bradycardia [13].

Bradycardia itself results in fall in systolic blood pressure. Diastolic blood pressure depends upon peripheral vascular resistance & lung inflation has been known to decrease systemic vascular resistance [14]. This response is initiated by pulmonary stretch receptors, which bring about withdrawal of sympathetic tone in the skeletal muscle blood vessels, leading to widespread vasodilatations, thus causing a decrease in peripheral resistance [15] and decreasing the diastolic blood pressure. Yoga on long duration affects hypothalamus and brings about decrease in systolic blood pressure through its influence on vasomotor center which leads to decrease in sympathetic tone and peripheral resistance, thus reducing diastolic blood pressure [16].

SKY practice of 'ujjayi' shifts parasympathetic dominance via vagal stimulation from somatosensory afferents in the glottis, pharynx, lungs and abdominal viscera. Thus SKY strengthens, balance, stabilize autonomic nervous system functions and establishes

parasympathetic dominance with decreased sympathetic drive [10].

SKY showed statistically significant decrease after 12 weeks of practice in the values of heart rate, systolic blood pressure and diastolic blood pressure in healthy subjects. The mechanism involved is by creating balance in autonomic nervous system functions by parasympathetic dominance and decreased sympathetic drive [17, 9].

By voluntarily controlling breathing patterns, it is possible to influence autonomic nervous system functions, including heart rate variability and cardiac vagal tone [18, 19]. Thus by establishing parasympathetic dominance SKY is beneficial to decrease blood pressure and heart rate in patients of hypertension. Our study showed that the systolic and diastolic blood pressure response to hand grip test was significantly lower in both the male and female group of control and study groups. ($p<0.05$)

Our findings are in consistent with Akhter *et al.;* [20] who conducted a cross sectional study which showed that mean values of resting heart rate, resting systolic and diastolic blood pressure were significantly ($p<0.05$) higher and both the sympathetic nerve function parameters (blood pressure response to hand grip and blood pressure response to standing) were significantly ($p>0.05$) lower in hypertensive compared to those of normotensive control subjects. So it can be revealed that sympathetic nerve function may be reduced in hypertension.

CONCLUSION

In our study the sympathetic function tests showed significant ($p<0.05$) decrease in both the prehypertensive and normotensive individual. So we can say Sudarshan Kriya Yoga can be used as an adjunct with diet and medicines in management of hypertension and anxiety.

SKY practices are cost-effective, well-tolerated tools that can be easily integrated into diverse community care models. SKY relieves stress and develops an individual's mind–body–spirit so that they can be happier, healthier, and possibly even longer lived.

In the competitive modern world, in which stress and anxiety are part of everyday life, adding a time-honored, evidence-based breathing program like SKY may facilitate a healthy life. So everyone should incorporate SKY into their life.

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