Effect of controlled breathing exercises on the psychological status and the cardiac autonomic tone: Sudarshan Kriya and Prana-Yoga

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Abstract

Objective: The objective of the study was to observe the effect of controlled breathing exercises including Sudarshan Kriya (SK) and Prana-Yoga (PY) on the psycho-physiological status.

Methods: The study group included 60 healthy volunteers (M:30, F:30) in the age group of 18 to 30 years (21.3±3.2 yrs), randomly divided in to three groups of 20 subjects each – (1) The SK group (2) the PY group and the (3) Control group. The psycho-physiological data was collected at the following four time interventions: Baseline, 6th, 60th and the 150th day. Psychological assessment was done using questionnaires and for the autonomic tone quantification Heart Rate Variability (HRV) analysis was done using the standard lead II electrocardiogram recordings.

In a post-hoc analysis each group was further sub divided in to the following two patterns, based on the baseline values of normalized Low Frequency (LF) power (cutoff 64 ms²) : (i) Pattern A-Subjects with low level LF power, and (ii) Pattern B- subjects with high level LF power.

Results: The stress management skills have shown significant increase in SK group but not in PY and Control group. Subjects of SK, PY, and control group showed significant increase in LF value and LF:HF ratio for pattern A and significant decrease for pattern B. Plotted LF value for pattern A & B in SK and PY practitioners showed convergence, coming to a mean value over the period of 150 days. The LF:HF ratio curve plotted over time for pattern A & B showed convergence in SK group only. No such convergence in LF value & LF/HF ratio for pattern A & B was seen in control group.

Conclusion: In conclusion, Sudarshan Kriya positively modifies stress coping behavior and initiates appropriate balance in cardiac autonomic tone.

Introduction

Pranayama is an ancient Indian practice that optimizes psycho-physical status and improves lifestyle. It involves controlled breathing maneuvers that
help to fine tune the Autonomic Nervous System (ANS). “Prana” means breathe or life and “ayama” means a pause, ergo, Pranayama is “a pause in the movement of breath” that is achieved by breathing exercises (1) and which supposedly helps in balancing the neuro-psycho axis tilt.

Physical and mental stress results in many psychophysiological disorders and consequently manifest as different cardiovascular, neurological and behavioral ailments (2). Psycho-physiological health benefits of pranayama practices have also been proven from improvement to prevention and management of the diseases (3).

According to the ancient yogic literature, certain breathing practices have been known to exhibit inhibitory as well as stimulating effects which induce calmness and arousal that alter the autonomic status and improve the psychological parameters. Fast breathing (Kapal-bhatipranayama) instantly modifies the autonomic status by increasing the sympathetic tone accompanied with a reduced parasympathetic tone (4, 5) while slow breathing increases the parasympathetic tone and decreases sympathetic activity and breathing through a particular nostril and “Om” meditation alters the metabolic and autonomic activities (6, 7, 8). Contrary results have also been reported stating increased sympathetic tone and withdrawal of vagal tone during “Sukh” Pranayama, which involves conscious, slow and deep breathing with equal duration for inhalation and exhalation (9). The authors also reported increased sympathetic tone during “Om” chanting (9). Studies on Pranayama practice like Sudarshan Kriya are known to alleviated expression, anxiety, post-traumatic stress disorder, stress-related medical illnesses, and rehabilitation of criminal offenders (10). Reduction in stress in advance stage patients of breast cancer was also observed with practice of SK and pranayama (11). The improvement in quality of life and sympathetic nervous system in diabetic patients with SK and pranayama along with standard treatment has also been reported (12, 13).

The present study was designed to find the effects of Sudarshan Kriya and Prana Yoga practices on psychological status and cardiac autonomic tone. We carried out psychological assessments for depression, anger, life style management and stress management skills along with standard short term heart rate variability (HRV) to quantify the cardiac autonomic tone.

Materials and Methodology

Subjects selection

Sixty healthy volunteers (30 males and females each, from the Indian Institute of Technology Delhi and the All India Institute of Medical Sciences, New Delhi) of similar socio-economic background, in the age group of 18 to 30 years (21.3±3.2 yrs), were randomly divided into three groups of 20 subjects each – (1) the Control group (2) the Sudarshan Kriya (SK) group, (3) the Prana-Yoga (PY) group. A training workshop was organized to explain the design of study to the students. Subject Information sheet was given and written informed consent was taken from each volunteer.

Protocol

Baseline data (before any intervention) was collected for volunteers. Six days of Sudarshan Kriya and Prana-Yoga training and practice under guided supervision was provided to respective groups. Control group did light recreational activity (leisure walking) for the same duration. The data acquisition was done post 6 days, 60 days and 150 days of practices. The subjects were asked to practice their respective exercises five days a week, till the final intervention at 150 days.

For psychological assessment standard scales of Depression, Anger, Life style management and Stress Management skills were used (14, 15). A continuous 5 minute ECG was acquired from the BIOPAC MP 150 module for the purpose of HRV.

Data acquisition and analysis

The MP-150 (Biopac Systems), a computer-based data acquisition system with software Acknowledge 3.8.2, was used to acquire the ECG signals on
standard lead II configuration. An ECG amplifier (ECG100C) was used to amplify the ECG signal in the frequency pass-band of 0.05-35 Hz with a gain of 1000. Disposable Ag-AgCl electrodes were used to record the ECG signal. The data was recorded for duration of five minutes. The ECG signal was processed for calculating the Heart Rate Variability (HRV) using in-house developed software namely, HRV-Soft. The frequency domain parameters including Low frequency (LF) and High frequency (HF) band power and LF/HF ratio were calculated for ECG acquired at every time point. The details of protocol, data acquisitions and analysis are shown in Fig. 1.

The procedure for doing Sudarshan Kriya and Prana-Yoga

Sudarshan Kriya was taught and supervised by an expert teacher from Art of Living organization as earlier described (16) and Prana-Yoga was taught by an expert in Pranic Practices based on ancient Indian Vedic scriptures (17). Subjects of the each group did their respective practices for 30 minutes for 5 days in a week till 150 days. Control group did 30 minutes of light physical recreational activity such as leisure walking. Brief procedure for doing Sudarshan Kriya and Prana-Yoga is attached as Appendix 1.

Statistical analysis

All psychological parameters and HRV parameters were compared at baseline between all 3 groups using one way-ANOVA, and the overall p-value was taken as significant at equal to or less than 0.05. Psychological, HRV parameters and mean R-R interval were compared within the group at each time point the using Generalized Estimating Equation (GEE). After Bonferroni correction p value equal to or less than 0.01 was taken as statistically significant. The statistical analysis was done using Stata 9 software.

Results

Comparisons showed that all psychological and HRV parameters for SK, PY and control groups were statistically non-significant (Table-I).

Psychological parameters

A statistically significant decline at 150th day was observed in Depression (22.7±5.1 to 18.6±4.8, P-value 0.01) and Anger (33.8±7.5 to 25.7±6.8 P-value 0.01) scales in the SK group only. Similarly, a

Fig. 1 : Study Protocol for data acquisition points and analysis. *The figure in parenthesis shows the number of subjects actually included and data analyzed after excluding dropouts and those who had noisy signal.
significant improvement in Stress management skills (56.7±7.7 to 66.7±6.8, P-value 0.01) was also observed in SK group only. Scores of life style management scales revealed improvement in both SK (38.6±6.3 to 45.2±6.5, P-value 0.01) and PY group (40.5±7.8 to 45±5.6, P-value 0.02). During intervening period, the improvements were visible from 6th day onwards in SK group for all psychological parameters and in PY group for life style management skills. In control group no significant changes were observed except in stress management skill only on 6th day of the study (Table-II).

Considering that the baseline values for psychological scores were different for different individuals, the percent change for baseline is shown in Fig. 2. The results clearly show significant changes as mentioned in Table-II.

**Heart rate variability (cardiac autonomic tone)**

Mean R-R interval (RRI) within the group and in between the group at every time point was found statistically non-significant (Table-III).

Also overall group analysis also did not give statistically significant results in LF, HF power and LF/HF ratio. It was observed that the normalized LF power at baseline has shown large variations; therefore a post-hoc analysis was performed. Each group was further classified in to the following two patterns based on the baseline values of normalized Low Frequency (LFnu) power (cutoff 64 ms²): (i) Pattern A – Subjects with LF power lower than 64 as Sympathetic hypo-reactor type, and (ii) Pattern B – Subjects with LF power more than 64 value as Sympathetic hyper-reactor type; shown in Fig. 3, such classification have been earlier used by Okinaka (18) using Mecholyl test response at rest.
TABLE II: Mean±SD and p-values of psychological parameters at Baseline, post 6 days, 60 days, and 150 days of practice.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Baseline Mean±SD</th>
<th>6 Days Mean±SD</th>
<th>60 days Mean±SD</th>
<th>150 Days Mean±SD</th>
<th>Overall P-value</th>
<th>Posthoc P-value</th>
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<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>0-6 Days 0-60 Days 0-150 Days</td>
</tr>
<tr>
<td>Control (n)</td>
<td>(n=15)</td>
<td>(n=14)</td>
<td>(n=15)</td>
<td>(n=13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>21.9±5.1</td>
<td>20.6±3.3</td>
<td>20.1±3.8</td>
<td>18.1±4.8</td>
<td>0.09</td>
<td>0.26 0.23 0.07</td>
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<tr>
<td>Anger</td>
<td>27.7±8.2</td>
<td>28.9±8.3</td>
<td>27.7±6.7</td>
<td>27.9±7.9</td>
<td>0.58</td>
<td>0.25 1.00 0.37</td>
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<tr>
<td>Life style</td>
<td>39.1±3.5</td>
<td>40.5±3.4</td>
<td>41.9±5.3</td>
<td>39.2±5.8</td>
<td>0.57</td>
<td>0.13 0.04 0.83</td>
</tr>
<tr>
<td>Stress Mgmt</td>
<td>59.3±4.3</td>
<td>56.9±4.7</td>
<td>58.7±6.2</td>
<td>61.6±7.2</td>
<td>0.22</td>
<td>0.01 0.65 0.29</td>
</tr>
<tr>
<td>Sudarshan Kriya (n)</td>
<td>(n=19)</td>
<td>(n=19)</td>
<td>(n=18)</td>
<td>(n=17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>22.7±5.1</td>
<td>19.3±3.0</td>
<td>18.8±3.9</td>
<td>18.6±4.8</td>
<td>0.01</td>
<td>0.01 0.01 0.01</td>
</tr>
<tr>
<td>Anger</td>
<td>33.8±7.4</td>
<td>30.3±6.8</td>
<td>29.3±6.5</td>
<td>25.8±6.8</td>
<td>0.01</td>
<td>0.02 0.01 0.01</td>
</tr>
<tr>
<td>Life style</td>
<td>38.6±6.3</td>
<td>43.5±7.4</td>
<td>43.0±7.2</td>
<td>45.2±6.5</td>
<td>0.01</td>
<td>0.01 0.01 0.01</td>
</tr>
<tr>
<td>Stress Mgmt</td>
<td>56.7±7.7</td>
<td>61.5±7.1</td>
<td>62.7±6.9</td>
<td>66.7±6.8</td>
<td>0.01</td>
<td>0.01 0.01 0.01</td>
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<tr>
<td>Prana-Yoga (n)</td>
<td>(n=16)</td>
<td>(n=15)</td>
<td>(n=16)</td>
<td>(n=14)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>18.3±5.2</td>
<td>18.5±3.9</td>
<td>17.6±3.8</td>
<td>17.9±5.0</td>
<td>0.70</td>
<td>0.88 0.59 0.84</td>
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<td>Anger</td>
<td>32.4±7.9</td>
<td>29.5±5.9</td>
<td>30.3±6.5</td>
<td>29.2±7.9</td>
<td>0.14</td>
<td>0.02 0.15 0.11</td>
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<tr>
<td>Life style</td>
<td>40.5±7.8</td>
<td>44.5±8.3</td>
<td>46.4±6.6</td>
<td>45.5±5.5</td>
<td>0.02</td>
<td>0.01 0.01 0.02</td>
</tr>
<tr>
<td>Stress Mgmt</td>
<td>63.6±1.0</td>
<td>62.5±9.5</td>
<td>64.9±7.5</td>
<td>66.7±9.9</td>
<td>0.14</td>
<td>0.14 0.44 0.23</td>
</tr>
</tbody>
</table>

TABLE III: The R-R interval (expressed in ms, inverse of heart rate), Mean±SD and p-values at varying time point for three groups.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Baseline Mean±SD</th>
<th>6 Days Mean±SD</th>
<th>60 days Mean±SD</th>
<th>150 Days Mean±SD</th>
<th>Overall P-value</th>
<th>Posthoc P-value</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0-6 Days 0-60 Days 0-150 Days</td>
</tr>
<tr>
<td>Control (n)</td>
<td>(n=15)</td>
<td>(n=12)</td>
<td>(n=12)</td>
<td>(n=10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean RRI</td>
<td>788±107</td>
<td>757±94</td>
<td>965±96</td>
<td>744±117</td>
<td>0.6</td>
<td>0.4 0.6 0.7</td>
</tr>
<tr>
<td>Sudarshan Kriya (n)</td>
<td>(n=17)</td>
<td>(n=19)</td>
<td>(n=17)</td>
<td>(n=16)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean RRI</td>
<td>791±104</td>
<td>776±103</td>
<td>771±107</td>
<td>779±95</td>
<td>0.4</td>
<td>0.4 0.4 0.6</td>
</tr>
<tr>
<td>Prana-Yoga (n)</td>
<td>(n=14)</td>
<td>(n=14)</td>
<td>(n=14)</td>
<td>(n=14)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean RRI</td>
<td>693±73</td>
<td>710±69</td>
<td>693±64</td>
<td>729±82</td>
<td>0.2</td>
<td>0.4 1.0 0.2</td>
</tr>
<tr>
<td>Overall p value between groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

Baseline normalized LF Power

LF <64 ms²
Sub Group: Pattern A

LF >64 ms²
Sub Group: Pattern B

Fig. 3: Sub-grouping of subjects on the basis of resting cardiac sympathetic tone (LF value represents normalized value).

The values of mean LF, HF, and LF/HF for pattern A & B were statistically compared between baseline and 150 days of practices and found significant as shown in Table-IV.

When the mean values of Pattern A & B of all three groups were plotted, the converging trends were observed, as shown in Figures (4-i and 4-ii).

Discussion

Mind-body interventions, such as yoga and pranayama practices are known to be useful for...
These figures show LF/HF ratio (4-i) and LF (4-ii) parameters for patterns A & B of Sudarshan Kriya, Prana yoga, and Control groups. In Sudarshan-Kriya group the LF values converged at the 150th day, while the LF/HF ratio converged after the 60th day itself. In Prana-Yoga group the LF values gradually converged after the 60th day but LF/HF ratio did not show similar pattern. In Control group the no particular pattern was observed for any parameter.
preventing mental and physical disorders (19, 20). Controlled breathing used for treatment of stress, anxiety, and depression mediate response by balancing the autonomic nervous system (21).

In the present study we saw a statistically significant reduction in the scores for scales of depression and anger in the SK group, which indicates improved efficacy for emotion control while no such change was seen in the subjects of PY and control group. Similarly, earlier studies on the SK have demonstrated its anti-depressant effect, (10). In the present study we also observed a statistically significant increase in the scores of the scales of the stress management skills and life style management for the SK group. These changes were observed by the 6th day of the study and continued for further evaluations made on the 60th and 150th day. Prana-Yoga group also revealed a continued statistically significant increase in the life style management skills. Similarly, other studies have documented lowered blood lactate level, improved anti oxidant status and increased optimism after the practice of SK (16, 22).

Described by Gelhorn (23), the Mecholyl Test was one of the methods for recognizing the functional state of the autonomic nervous system at rest by identifying the patterns of the blood pressure curve. Using the Mecholyl test, Okinaka (20) classified the blood pressure response curve in to the following three types – (a) S-type (Sympathetic hyper-reactor), (b) N-type (Norm-reactor) and the (c) P-type (Sympathetic hypo-reactor). King (1958) supported process-reactive classification based on Mecholyl test for research in schizophrenia (24). Kawakami (1989) carried out a study on vegetative dystonia patients diagnosed with functional symptoms. He also used the Mecholyl Test, as classification of subjects based on autonomic response. Subjects were analyzed for psychosomatic disorders. He observed that different types of autonomic types exhibited different relationship with disease typing (25). In terms of psychologic classification, the subjects are divided into Type A and Type B and the correlation between personality type and autonomic nervous system has been revealed by many studies. Type A personality is found to be highly associated with sympathetic hyper reactivity and it may trigger myocardial infarction and related cardiovascular insults (26, 27). These studies justify our classification of subjects into pattern A & B subgroups. Therefore, the subjects were classified likewise Okinaka (18), but here based on baseline normalized LF power (cutoff 64 ms²), in to (i) Pattern A, (subjects having low sympathetic tone) and (ii) Pattern B, (subjects having high sympathetic tone) for each of the 3 groups i.e. the Control, SK and the PY groups.

The trends in the plotted LF value and LF:HF ratio for Sudarshan Kriya and Prana-Yoga were found different from the control group. Plotted graphs of LF value and LF:HF ratio for Sudarshan Kriya group showed convergence in the pattern A and B, to a mean value over the period of 150 days, as shown in Fig. 4(a) & (b). Simultaneously significant improvements in anger, depression, stress and life management skills were also found. It indicates that Sudarshan Kriya initiates appropriate adjustment to balance cardiac autonomic tone and which possibly facilitates stress coping behavior and better emotion control. Similarly Prana-Yoga practitioners also showed convergence in the plotted LF values for pattern A & B. In PY group LF decreased more in pattern B subjects as compared to SK group but did not reflect improved trend in LF:HF ratio plot. At the same time change in anger and stress management skills also found non-significant. Long term cyclic fluctuations over months in LF and HF and their ratio is a unique observation. As all the subjects were normal so this should be consider as normal physiological response. With the practice of controlled breathing it has been seen that overall HRV increases and large increase is seen in parasympathetic component (HF) then sympathetic component (LF). Therefore behavioral intervention tones up overall autonomic activity including some changes in LF components.

Respiration can induce oscillations in various autonomic drives and it has been confirmed with many studies on different pranayama techniques (4-9). Sudarshan Kriya is a rhythmic cyclic breathing
at varying rates and depths interspersed with definite pauses. Prana-Yoga is set of breathing exercises with focus on uni-nostril, bi-nostril breathing and mainly low frequency breathing with varying physical focusing. Ujjayi breath is common to both controlled breathings and it is hypothesized that it increases vagal modulations i.e. respiratory sinus arrhythmia (RSA) and HRV, which are possibly necessary for cardiovascular recovery from psychological stress (28). Brown (2005) in his model proposed that slow yogic breathing induces oscillations in the blood pressure and enhanced RSA. This strong respiratory rhythm in the vagus nerve along with inspiratory resistance induces increase in the parasympathetic and sympathetic input to the sinoatrial node. Increased HRV and RSA activate hypothalamic vigilance area and induce a clam but alert state (21).

Voluntary slow deep breathing functionally may reset the autonomic nervous system and synchronizes brain with the autonomic response (29, 30). Bhastrika pranayama and high frequency breathing during different cyclic rhythms of Sudarshan Kriya induces sympathetic stimulation consequently dramatic hemodynamic responses occurred with compensatory adjustment in local vasculature. As hypothesized earlier by one of the co-authors, repeated episodes of sympathetic activation results in hypocapnic internal milieu, and this altered sympathetic activity develops better ability to tolerate stress. Repeated rapid breathing interspersed with adequate pauses of slow breathing results in episodes of sympathetic excitation and lowering, which improves recovery of sympathetic tone with each episode, consequently it provides relaxation with clear thinking (31). In the present study only in Sudarshan Kriya group, we found improved cardiac autonomic tone along with the improvement in the life and stress management skills and better emotional control, which supports the above mentioned hypothesis (31).

Thus it is apparent that elevated health benefits due to controlled breathings are mainly supposed to mediate through improvement in autonomic balance. The question arises that, is there more robust basis for their psycho-physiological changes? Sudarshan Kriya has been shown to have gene transcription regulation which explains its multifarious health benefits in immunity, age, cell death and stress (32). Similarly a recent research from Norway showed rapid gene expression alterations in practitioners of SK (33). These studies provide the basis for their longer term cell biological and higher level health effects of SK.

In summary, Sudarshan Kriya and Prana-Yoga provides a kind of autonomic training that ultimately strengthen, stabilize and enhance the flexibility of the autonomic nervous system. More long term multi-centric studies are required to further validate the study findings. The study points out the fact that autonomic controls (LF and HF) show long term cyclic fluctuations over months. A further study with periodical recording of autonomic nervous system drives may help to decipher this issue.

Conclusion

In conclusion, Sudarshan Kriya practice induces appropriate adjustments in the balance of cardiac autonomic tone for better psycho-physiological functioning. Regular practice of Sudarshan Kriya positively modifies stress coping skills as well as cardiac autonomic tone with better emotional control.

Acknowledgements

The authors are thankful to Dr. Ved Vrata Alok for teaching Prana-Yoga practices and Dr. Jayashree Santhosh, Mr. Abhinav Gupta for their continuous invaluable support. The authors are grateful to the Department of AYUSH, Ministry of Health and Family Welfare for their financial assistance.
### Appendix 1

**Brief procedure for Sudarshan Kriya and Prana-yoga**

#### Sudarshan Kriya

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of Controlled breathing</th>
<th>Details of procedure</th>
<th>Total duration (min):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Repetitions (cycles);</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rest periods (sec.)</td>
</tr>
<tr>
<td>1.</td>
<td>m Vibhag pranayama</td>
<td>1) First stage;</td>
<td>1) 3 min;</td>
</tr>
<tr>
<td></td>
<td>n 3 stage Pranayama in Ujjayi breathing (Constriction of pharynx while breathing through nostril)</td>
<td>Place thumb on hip bone, fingers towards the navel region.</td>
<td>8 cycles; 30 sec.</td>
</tr>
<tr>
<td></td>
<td>o Slow breathing 3 cycles per minute (0.05Hz)</td>
<td>2) Second stage;</td>
<td>2) 3 min; 8 cycles; 30 sec.</td>
</tr>
<tr>
<td></td>
<td>p Inhale in Ujjayi breath, hold, exhale and hold for the count 4:4:6:2 respectively, makes one cycle. Each stage is followed by resting position, palm on knees facing the ceiling.</td>
<td>Place thumb under the armpit, elbows parallel to the ground, fingers towards the chest region.</td>
<td>6 cycles; 30 sec.</td>
</tr>
<tr>
<td></td>
<td>m Bhastrika pranayama</td>
<td>3) Third stage;</td>
<td>3) 2-3 min; 6 cycles; 30 sec.</td>
</tr>
<tr>
<td></td>
<td>n Rapid exhalation at 20 times per minute (0.3 Hz)</td>
<td>Place loose fist in front of the shoulders, elbows touching to the trunk. While inhaling in normal breath, move hands upward and open the fist, return to the initial position while exhaling.</td>
<td>4-4-6-2 breaths-in and breath-out makes one round. Each round is followed by resting position, palm on knees facing the ceiling.</td>
</tr>
<tr>
<td></td>
<td>o Sit in thunderbolt pose (Vajrasan), eyes closed.</td>
<td>4) Sudarshan-Kriya</td>
<td>3-4 min; 3 rounds; 30 sec. after every round.</td>
</tr>
<tr>
<td></td>
<td>p Inhale in and out in normal breath -20 times breath-in and breath-out makes one cycle.</td>
<td>Inhale and exhale 20 times in long rhythmic, cyclic normal breathing in slow (12 breaths/min, 0.2 Hz), medium (30 breaths/min, 0.5 Hz) and Fast cycles (60 breaths/min, 1.0 Hz).</td>
<td>7-8 min; 3 times</td>
</tr>
<tr>
<td></td>
<td>o Sit in sukhhasan, eyes closed.</td>
<td>p Do three rounds of 20-40-40 breaths in slow, medium and fast pace.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>m Rest in shavasan</td>
<td>Take attention to different parts of the body from toe to head.</td>
<td>10 min; 1</td>
</tr>
<tr>
<td></td>
<td>Lying down on the back, keeping hands to the side of the body and legs one foot apart.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Prana-Yoga

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of Controlled breathing</th>
<th>Details of procedure</th>
<th>Total duration (min):</th>
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</thead>
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<td></td>
<td></td>
<td></td>
<td>Repetitions (times);</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rest periods (sec.)</td>
</tr>
<tr>
<td>1.</td>
<td>m Hams Pranayama (slow breathing)</td>
<td>Listen to the sound so produced, ‘HUM’ while exhaling, and ‘SA’ while inhaling.</td>
<td>2 min; 10 times; 30 sec.</td>
</tr>
<tr>
<td></td>
<td>n 5 breaths/min (0.08 Hz)</td>
<td></td>
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<td></td>
<td>o Sit with erect spine, eyes closed, adopt the relaxed-Dhyani-Mudra, (the index finger-tip touching the thumb-tip), placing both the palms on the knees.</td>
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<tr>
<td>2.</td>
<td>m (a) Chandrabhedi Pranayama</td>
<td>(a) Inhale &amp; exhale through left nostril.</td>
<td>(a) 1 min; 5 times; 30 sec.</td>
</tr>
<tr>
<td></td>
<td>n 5 breaths/min (0.08 Hz)</td>
<td></td>
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<tr>
<td></td>
<td>o Sit with erect spine, eyes closed,</td>
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</table>
Breathing in and out through left nostril only.

(b) Suryabhedhi Pranayama
- 5 breaths/min (0.08 Hz)
- Sit with erect spine, eyes closed,
- Inhale & exhale through right nostril. 5 times;
- Sit with erect spine, eyes closed, rest on the left knee.

3. Anulome-Vilome Pranayama
- Inhale through the left nostril. 2-3 min;
- 2 cycles/min (0.03 Hz) 2. Exhale through the right nostril. 5 times;
- Sit comfortably, spine erect, eyes closed, adopt Dhyana-mudra by left hand and
- Inhale through right nostril. 30 sec.
- Exhale through left nostril.

4. Kapal-bhati Pranayama
- Inhale through the teeth, placing the tongue at the gums and producing a sizzling 'Seetkaree' sound. Keep the sizzling sound at the larynx and the vocal cord.
- Place the four finger-tips of both the upper and lower teeth lines apart.
- Keep the in-held breath to the capacity. 1 min;
- While exhaling, produce a bee-humming sound at the larynx and the vocal cord.

5. Bhramari Pranayama
- Inhale deeply; raise both arms and torso up, Exhale forcefully 5 times;
- Position as above, Place the fist on the knees, while elbows gently touching the sides of your torso.
- Fold both the arms at elbow to bring palms to shoulder level.

6. Tribhandha Kumbhaka
- Inhale deeply, hold and pull in anus for Moola bandha, the root lock, squeeze in the navel for Uddiyana-Bandha, the abdominal lock, and finally lower the chin for Jalandhara Bandha, the throat lock. Together they are known as Tribandha Kumbhak.

References

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