Original Article

Study of immediate neurological and autonomic changes during *kapalbhati pranayama* in yoga practitioners

Varun Malhotra[1], Danish Javed[2], Santosh Wakode[1], Rajay Bharshankar[1], Neha Soni[1], Patrick K. Porter[3]

[1]Departments of Physiology and [2]AYUSH, AIIMS, Bhopal, Madhya Pradesh, India, [3]Chief Brain Tap Officer, BrainTap, Quantum University, Honolulu, HI, USA

Abstract

Background: *Kapalbhati* is a fast pace respiratory exercise or *pranayam*, which is supposed to be practiced by yogis to clean their brain. *Pranayamas* are well known to improve heart rate variability (HRV) ultimately leading to better autonomic functions. Other studies have observed the immediate effect of *kapalbhati* on various neurological (brain and spine) and autonomic functions, but their results are varied and inconclusive. **Objective:** The aim of this study is to find out the changes in HRV and brain waves during and after practice of *kapalbhati* as compared with the baseline values of different parameters. **Methods:** Various parameters were measured at baseline, during and after *kapalbhati pranayam* with the help of Dinamika HRV-Advanced HRV Test System, Moscow, Russia. Statistical analysis was accomplished employing repeated measures analysis of variance with Bonferroni post-hoc analysis and Holm's multiple comparisons using the Version 28.0.0.0 of the Statistical Package for the Social Sciences (SPSS) for Windows (190) SPSS Inc., Chicago. **Results:** We found that during and after *kapalbhati*, changes in HRV were significant in time and frequency domain showing parasympathetic withdrawal and insignificant changes in brain waves as compared with reference point values. **Conclusion:** *Kapalbhati* is initially energizing, cleansing, and heating. There occurs parasympathetic withdrawal and sympathetic activation during *pranayama*. There is an increase gamma wave activation post *pranayama* showing control of the default mode network.

Keywords: Autonomic nervous system, brain spectrum of waves, EEG, HRV, *Kapalbhati*

Introduction

In Yoga, different breathing techniques are used to perform in the *pranayama*. Few of them are at a slow pace while others are fast. *Kapalbhati* is a fast or high frequency (approximately 1 to 2 Hz) breathing technique, in which short and quick vigorous exhalations are performed with effortless inspirations. It has been reported to improve cardiovascular, respiratory, mental, and physical health on different parameters.

Many studies performed to find the effect of *kapalbhati* on heart rate variability (HRV) advocate that it causes sympathetic activation and parasympathetic withdrawal during the procedure but after the resting period, parasympathetic modulation is much higher. A study conducted over 57 medical students of the first year, concluded that 2 months of practice of regular *pranayam* including *kapalbhati* helped them to reduce their stress score along with the significant changes in HRV by a reduction in very low frequency (VLF) and low frequency

Address for correspondence: Dr. Varun Malhotra, Associate Professor, Department of Physiology, AIIMS, Bhopal, Madhya Pradesh, India.
E-mail: varun.physiology@aiimsbhopal.edu.in

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(LF), increase in high frequency (HF), and reduction in LF/HF ratio. This signifies better parasympathetic control and reduced sympathetic cardiac drive after *kapalbhati*.[1] In contrast, another study conducted on 20 healthy volunteers demonstrates that the acute effect is mainly on the arousal of sympathetic activation and further may be a cause of ill cardiac health and may promote cardiac arrest. During *kapalbhati*, they discovered a significant increase in LF band power and LF/HF ratio, as well as a decrease in the HF component.[2] It has been also postulated that 5 min of *kapalbhati* is equivalent to half hour of exercise. Noteworthy, we have also seen similar cardiac changes during exercise. In community, *yoga* and *pranayama* may be a preventive strategy against cardiovascular disorders.

However, in another study, it was noted that parasympathetic withdrawal is present just after *kapalbhati*, but after 20 min of relaxation period, parasympathetic dominance was present significantly in all the subjects.[3] Parasympathetic shift of HRV is responsible for good cardiac health and less chances of sudden cardiac death. Acute effects of *kapalbhati* noted in a study were the initial rise in heart rate, systolic and diastolic blood pressure, and gradual fall in all these parameters just after the procedure.[4] Continuous Transcranial Doppler monitoring of middle cerebral artery before, during, and after the practice of *kapalbhati* showed significant reductions in end-diastolic velocity, and mean flow velocity with a significant increase in pulsatility index suggests sympathetic activation of brain activity.[5] *Kapalbhati* has been found to augment general health fitness. *Singh B*[6] carried out a study on 28 university girls and found that 1 month's practice of *kapalbhati* improved the various health-related parameters like cardiorespiratory endurance, lean body mass, body flexibility, fat percentage, and fat weight in the body. The possible use of *kapalbhati* is to combat metabolic syndrome (MS) and polycystic ovarian syndrome. Fast breathing increases basal metabolic rate, reduces fat deposition, and ultimately ends up in weight reduction as also reflected by a decrease in both waist circumference and hip circumference.[7,8] The exercise also increases hepatic and lipoprotein lipases which induces increased uptake of triglycerides and is helpful in MS. The abdominal bellows during active exhalation during *Kapalbhati* helps in release of insulin from pancreas and decrease hyperglycemia.[9,10]

After 4 weeks of *kapalbhati* training in 50 girls, another study by the same investigator found substantial variations in spirometry parameters such as tidal volume, expiratory reserve volume, vital capacity, and inspiratory capacity in the experimental group.[11] The effect of 6 weeks of *kapalbhati pranayama* was analyzed on 60 healthy subjects, which illustrates the significant improvement in peak expiratory flow rate and helps improve pulmonary function. *Kapalbhati* breathing benefits also include soothing sinus and asthma.[12]

It can be postulated that *kapalbhati* practice imparts its effect on the cardiovascular and cerebrospinal system but there are very few studies on parameters like HRV and brain waves especially during pranayama. Besides, the abovementioned studies have varied inconclusive results on its effects on HRV. So, we proposed this study to examine the acute events during and after *kapalbhati* on HRV and brain waves so as to compare with the baseline values.

Materials and Methods

Study setting: The study work was done at the Department of Physiology and AYUSH, AIIMS, Bhopal, MP (India). Ethical approval was received from Institutional Human Ethics Committee before the commencement of research vide letter no IHEC No. IM079.

Study design: Prospective interventional study.

Study duration: 2 months.

Sample size: Assuming the α error as 0.05, power 80%, and medium effect size 0.3 based on previous studies, the sample size is 20 for repeated measures analysis of variance (RM-ANOVA). This was calculated using G power software. Twenty healthy regular yoga practitioners of average 44 years and normal BMI, who gave consent for the study, were randomly selected from Yoga unit of AYUSH department, AIIMS Bhopal.

Exclusion criteria: Persons with lung diseases or low (compromised) pulmonary functions, cardiac diseases, history of smoking, dyspnoea while walking, pedal edema, or high blood pressure were excluded from the study.

Intervention/procedure: As is ideal, the *kapalbhati pranayama* was conducted under the supervision of a qualified yoga practitioner. The person was seated in a comfortable sitting posture with the spine straight and body relaxed. The subject was asked to sit in a chair with a straight spine and stomach in, shoulder blades drawn together, and chin parallel to the ground.

Kapalbhati pranayam starts with the deep inhalation followed by exhalation of breath with mild and violent movements of the diaphragm and abdominal muscles. This procedure was done for 5 min.[13] This is a very vigorous procedure and in a case study, pneumothorax was also reported in *kapalbhati* yoga practitioner.[14] So, it is advised that precautions need to be taken during its practice. This pranayama should not be done in excess and should only be done after the consultation and supervision of experts only. So, it was restricted to only 5 min.

Measurement of parameters: The HRV and psychophysical parameters were recorded before, that is, at resting sitting comfortable posture for 5 min using HRV Brain Tap Dinamika Machine (Dinamika HRV—Advanced HRV Test System, Moscow, Russia). The Dinamika HRV is a novel digital analyzer used to measure HRV by neurodynamic analysis. It measures an electrocardiogram recording with real-time monitoring of functional state indices. It analyzes the human heart rate extracted from an electrocardio signal in the broad range frequency band.

The software and the hardware of Dinamika meets the standard of measurement, physiological interpretation, and clinical use of cardiac intervalometry indices, adopted by European society of cardiology and North American association of electrophysiology.[15,16] The HRV parameters can be assessed within 5 min.

The devices used were two electrodes for the wrist and a laptop with the software "Dinamika" mobile HRV unit that is available at Department of Physiology. The electrodes were placed on the wrist with water or jelly. The baseline record of the subject was taken for 5 min. The record of the parameters was taken again during 5 min of *kapalbhati* and immediately after *kapalbhati* in the same sitting posture. The brain wave spectrum was also measured in these three intervals.

Statistical analysis: Data were analyzed for normalcy and found to be parametric; therefore, it is presented in Mean ± SD. The resting and after readings of HRV, EEG, parameters were statistically compared and analyzed. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) for Windows, Version 28.0.0.0, and we used repeated measurements of analysis of variance with post-hoc analysis with Bonferroni and Holm's multiple comparisons (190) SPSS Inc., Chicago. On the off chance that the *P* value comparing to the F-static of ANOVA is lower than 0.05, proposing that at least one group is significantly unique. The Bonferroni and Holm's multiple comparison post-hoc tests would almost certainly recognize which of the sets of comparison groups is essentially not the same as one another. In the event that it is more than 0.05, recommending that the groups are not essentially unique for that level of significance.

Results

Mean heart rate, LF power (nu%), LF/HF ratio, LF%, and VLF% increased during the *kapalbhati* practice and further decreased after rest. Standard deviation of all NN intervals (SDNN), NN50 count divided by the total number of all NN intervals (pNN50), the square root of the mean of the sum of the squares of differences between adjacent NN intervals (RMSSD), total power, HF, LF, VLF, HF power (nu%), and HF% were decreased and then increased again during resting period after the *kapalbhati*. Delta wave increased during period and further decreased. Beta and Gamma waves got increased after the *kapalbhati*, while Theta and Alpha waves were remained almost unchanged throughout the procedure. These changes were examined through RM-ANOVA, and it was reported that changes in Mean Heart rate, SDNN, RMSSD (ms), pNN50 (%), total power (ms^2), HF (ms^2), HF power (nu%), LF power (nu%), LF (nu%), LF/HF ratio, HF%, and VLF% were highly significant (P < 0.001), while LF (ms^2) and LF% were significant (P < 0.05). Values of VLF (ms^2) were only insignificant in time and frequency domain. HF, HF%, HF Power, SDNN, and RMSSD were significantly lower during *kapalbhati* showing parasympathetic withdrawal during the maneuver as compared

Table 1: Heart rate variability parameters before, during, and after *kapalbhati*

Parameters	Pre Kapalbhati (A)	During Kapalbhati (B)	Post Kapalbhati (C)	Repeated Measures ANOVA *F* (df 2,57) (*P*)	*Post hoc* test (*Bonferroni* and *Holm* multiple comparison): Difference between groups *F* (*P*)	Difference within groups *Bonferroni* and *Holm* T-statistic (P-*Bonferroni* and *Holm*): A-B	A-C	B-C
Mean heart rate (bpm)	73.85±7.27	77.45±7.27	72.85±5.44	19.24106 (<0.00001)**	2.59637 (0.08334)	1.6954 (0.2863,0.1909)	0.4709 (1.9184,0.6394)	2.1663 (0.1034,0.1034)
Time domain								
SDNN (ms)	41.26±15.96	29.47±7.47	45.51±9.48	12.53724 (0.000066)**	7.096836 (0.00177)*	3.2272 (0.0062**,0.0041**)	0.0698 (2.8337,0.9445)	3.2970 (0.0050**,0.0050**)
pNN50 (%)	12.55±15.51	0.7±1.26	15.05±13.47	17.7228 (<0.00001)**	8.324083 (0.000673)*	3.1536 (0.0077**,0.0051**)	0.6653 (1.5255,0.5085)	3.8189 (0.0009**,0.0009**)
RMSSD (ms)	32.46±13.90	14.61±3.5	34.3±10.10	55.62797 (<0.00001)**	23.076468 (<0.00001)*	5.5714 (0.0001**,.0001**)	0.5809 (1.6908,0.5636)	6.1523 (0.0001**, 0.0001**)
Frequency domain								
Total power (ms^2)	1762.6±1346.95	802.9±362.98	1653.15±738.29	10.65526 (0.000212)**	6.647373 (0.0025)**	3.3304 (0.0045**,0.0045**)	0.3798 (2.1164,0.7054)	2.9506 (0.0137*,0.0091**)
HF (ms^2)	430.25±422.73	60.25±38.79	500±330.76	24.10657 (<0.00001)**	11.57228 (0.00006)**	3.7658 (0.0011**,0.0007**)	0.7099 (1.4419,0.4806)	4.4757 (0.0001**,0.0001**)
LF (ms^2)	555.5±620.14	269±149.95	502.75±426.72	4.16667 (.023116)*	2.362562 (0.10334)	2.0423 (0.1372,0.1372)	0.3764 (2.1240,0.7080)	1.6659 (0.3036,0.2024)
VLF (ms^2)	776.7±652.20	473.3±247.39	650.6±384.07	2.4385 (.100838)	2.198309 (0.120314)	2.0869 (0.1241,0.1241)	0.8674 (1.1681,0.3893)	1.2196 (0.6829,0.4553)
HF Power (nu%)	49.4±20.14	18.82±8.7	54.38±20.81	42.63943 (<0.001)**	22.831932 (<0.001)**	5.5005 (0.0001**,0.0001**)	0.6491 (0.0001**, 0.0001**)	6.1497 (0.0001**,0.0001**)
LF power (nu%)	50.59±20.14	81.18±8.7	46.98±21.12	42.63943 (<0.001)**	22.831932 (<0.001)*	5.5005 (0.0001**,0.0001**)	0.6491 (1.5566,0.5188)	6.1497 (0.0001**,0.0001**)
LF/HF ratio	1.7±2.21	5.17±2.26	1.76±0.81	25.24707 (<0.001)**	13.258315 (0.000019)*	4.4950 (0.0001**,0.0001**)	0.0718 (2.8289,0.9429)	4.4232 (0.0001**, 0.0001**)

Legend - Values are Mean±SD (n=20). SDNN, Standard Deviation of all NN intervals; pNN50, NN50 count divided by the total number of all NN intervals; RMSSD, the square root of the mean of the sum of the squares of differences between adjacent NN intervals; HF, High frequency in normalized units; LF, Low frequency in normalized units. P. P1 compares pre and during Kapalbhati values, P2 compares Pre and After Parameters and P3 compares during and after values. Statistically significant. **P<0.01, *P<0.05

Table 2: Relative percentages of LF, HF, and VLF percentages pre, during, and post *kapalbhati*

Parameters	Pre Kapalbhati (A)	During Kapalbhati (B)	Post Kapalbhati (C)	Repeated Measures ANOVA *F* (df 2,57) (*P*)	*Post hoc* test (*Bonferroni* and *Holm* multiple comparison)			
					Difference between groups *F* (*P*)	Difference within groups *Bonferroni* and *Holm* T-statistic (P *Bonferroni* and *Holm*		
						A-B	A-C	B-C
LF%	27.75±12.40	34.6±10.78	28.7±16.32	3.13847 (.054767)*	1.540374 (0.223088)	1.6199 (0.3323,0.3323)	0.2247 (2.4691, 0.8230)	1.3952 (0.5050,0.3367)
HF%	28.25±18.90	8.6±4.62	31.85±14.41	31.04413 (<0.0001)**	20.403814 (<0.00001)**	5.0281 (0.0001**, 0.0001**)	0.8983 (1.1183, 0.3727)	5.9264 (0.0001**,0.0001**)
VLF%	43.95±12.99	57.25±12.47	39.5±11.79	12.78639 (.000057)**	11.052144 (0.000088)**	3.3854 (0.0038**, 0.0025**)	1.1327 (0.7862, 0.2620)	4.5181 (0.0001**,0.0001**)

Table 3: Relative percentages brain waves percentages pre, during, and post *kapalbhati*

Parameters	Pre Kapalbhati (A)	During Kapalbhati (B)	Post Kapalbhati (C)	Repeated Measures ANOVA *F* (df 2,57) (*P*)	*Post hoc* test (*Bonferroni* and *Holm* multiple comparison)			
					Difference between groups *F* (*P*)	Difference within groups *Bonferroni* and *Holm* T-statistic (P *Bonferroni* and *Holm*)		
						A-B	A-C	B-C
Delta	49.75±15.22	52.25±13.03	51.5±12.96	0.2267 (.798228)	0.173334 (0.841299)	0.5737 (1.7053,1.7053)	0.4016 (2.0684,1.3789)	0.1721 (2.5918,0.8639)
Theta	22.6±10.32	20.55±7.6	18.8±19.4	0.93919 (.399829)	0.858629 (0.42915)	0.7062 (1.4487,0.9658)	1.3091 (0.5872,0.5872)	0.6029 (1.6469,0.5489)
Alpha	13.6±4.61	13.1±6.34	12.8±6.57	0.14673 (.864018)	0.106481 (0.89917)	0.2944 (2.3085,1.5390)	0.4550 (1.9525,1.9525)	0.1606 (2.6189,0.8729)
Beta	8.2±4.38	8.8±3.97	9.15±5.32	0.35363 (.704424)	0.197419 (0.821405)	0.3924 (2.0887,1.3925)	0.6212 (1.6107,1.6107)	0.2289 (2.4593,0.8197)
Gamma	5.8±3.7	5.2±3.33	7.85±6.7	1.92383 (.160006)	1.661308 (0.198952)	0.3935 (2.0861,0.6953)	1.3446 (0.5522,0.3681)	1.7381 (0.2627,0.2627)

with before and after values. LF power and LF/HF ratio increase significantly during *kapalbhati* showing sympathetic activation. All the brain wave changes were found insignificant throughout the procedure. Post-hoc Bonferroni and Holm's multiple comparison tests were done to find out between the group and within the group changes [Tables 1–3].

Discussion

HRV and *Kapalbhati Pranayama*

During *Kapalbhati pranayama,* HF is significantly lower during *kapalbhati* showing parasympathetic withdrawal during the maneuver. The HF ratio increases *post kapalbhati* showing parasympathetic activation after *Kapalbhati* [Table 1]. During *kapalbhati*, violent exhalations lead to a decrease in carbon dioxide and a loss of hypercapnic drive. The resultant cessation of breathing or apnea gives much-needed rest to the heart and breathing process.[17] In the resulting apnea state after *Kapalbhatti*, due to expulsion of body carbon dioxide, our practitioners become still and reported a feeling of joy.

In slow deep breathing, the rate is less than 7 breaths per minute. The findings of research we conducted earlier show that slow deep breathing exercises are calming and cooling. There is the activation of parasympathetic system during slow breathing.[18] *Kapalbhati* is initially energizing, cleansing, and heating. Finding of a prospective open-label pilot study suggests that during fast breathing as in *kapalbhati pranayama,* there is a parasympathetic withdrawal occurring.[19] In fast breathing, the breathing rate is greater than 60 breaths per minute. In this study, the HRV parameters also showed statistically significant parasympathetic withdrawal occurring during *kapalbhati* as compared with the resting state (RMSSD and HF ratio decreased). Time-domain parameters such as RMSSD, NN50, and pNN50 represent activity of parasympathetic nerves. RMSSD is most reliable as it is not influenced by respiration. Ideally, 24-h ECG is needed to analyze the time domain parameters. Effect of *kapalbhati pranayam* in an acute setting of 5 min, therefore, needs to be assessed by analysis of the frequency domain parameters such as LF, HF, and LF/HF ratio. Here, LF and LF/HF ratio increased statistically significantly during the *kapalbhati* practice showing sympathetic activation. Our findings, similar to two studies that measured HRV during rapid *kapalbhati* breathing, reported decreased LFms and HFms,[20,21] whereas two studies that compared HRV before and after *kapalbhati* breathing reported increased low frequency in normalized units (LFn.u) and reduced high frequency in normalized units (HFn.u).[22] or no change in LFn.u. and HFn.u. and a reduction in pNN50 after the practice[23] [Table 2].

During deep breathing as in *kapalbhati pranayam,* there is stretching of the pulmonary receptors similar to that of the Hering-Breuer reflex. This increases the frequency of the inhibitory neuronal impulses and brings about withdrawal of the sympathetic tone in the blood vessels. It has been shown that if a parasympathetic blocker like hyoscine-N-butyl bromide is administered to the subject doing pranayama, there would be no decrease in the blood pressure. This shows that parasympathetic activation occurs with practice of *kapalbhati pranayama*.[23] The changes of HRV during *Kapalbhati* are similar to that of physical exercise and the cardiovascular improvement during *kapalbhati* are excessive but not correlated with intensity of exercise. A person unwilling or unable to exercise may receive similar benefits to physical exercise if he practices *kapalbhati* pranayama.

EEG and HRV: Spectrum of brain activity

Delta, Theta, and Alpha waves decreased and Gamma and Beta waves increased after *kapalbhati pranayama* [Table 3]. The changing spectrum of EEG waves before, during, and after *kapalbhati* was not statistically significant. This may be due to the fact that this was an acute study in which the *pranayama* maneuver was only for 5 min. Further studies need to be devoted to understanding the effects of *kapalbhati* done for a longer time on Brain spectrum of EEG waves. Nevertheless, our study resonated with another similar study on Satyananda Yogis, which showed that those who were practicing for 4 years have an increase in theta and alpha (low-frequency oscillations) in the right superior frontal, right inferior frontal, and right anterior temporal lobes, whereas, those who were practicing for 30 years had increased in beta and gamma (high-frequency oscillations) in the same regions.[24]

Our study is on yoga practitioners who are practicing meditation and slow deep *pranayama* for the last 10 to 16 years and also support the increase in beta and gamma activity. The default mode network in frontal areas of brain is linked to gamma oscillations. Its increase reflects an increased coherence seen in Buddhist monks and those practicing mindfulness meditations for years.[25,26] Other studies also reveal that long-term meditation practice causes high amplitude gamma synchrony in EEG recordings across the parieto-temporal and frontal lobes.

Two reports are available indicating certain unusual EEG patterns during *Agnisara kriya*.[27] During this practice, EEG pattern showed bursts of 50 to 100 microvolt amplitude waves in the frequency of 12 to 13 Hz. These waves seemed to occur preferentially during the retraction of the abdominal wall and at the Pre-Rolandie areas of the brain. They hypothesized that the brain responds to the somatovisceral inputs arising from the abdominal wall activity. Further, exercises such as *Nauli, Bastrika,* and *Suryabhedana* seem to have characteristic frequencies between 12 and 17 Hz and between 26 and 33 Hz with specific cortical localizations. Hence, the conclusion is that these *Pranayamas* stimulate specific receptors in the body, each of which has, in their turn, specific frequency of activity and localization in the brain.

Pranayama brings changes in brain connections-especially involved in emotional processing in areas of insula, cingulate gyrus, amygdala, and prefrontal cortex. There is an increase in gamma activity that is associated with the default mode network.[28]

Theta oscillation in the frontal cortex has been linked to mindfulness meditation and parasympathetic dominance in the literature.[12,29] Vialatte *et al*.[28] discovered a considerable drop in theta activity during Bhramari Pranayama (BhPr), despite the fact that they claimed it was increased in their discussion. After practicing BhPr, they discovered hypersynchronous activity in the high gamma range in the left medial temporal lobe, which was described as high frequency biphasic ripples. Ripples in the medial temporal lobe have been linked to neuroplasticity and human memory consolidation in a prior study;[30] however, this is a contentious topic. While some researchers claim that fast oscillations may predispose meditators to seizures and that gamma oscillation is linked to the frontal default mode network,[25,26] others show that long-term meditation practice bilaterally induces high amplitude gamma synchrony in EEG recordings over the parieto-temporal and midfrontal cortical areas.[31,32] The intracortical theta (4–8 Hz) oscillation is linked to attention modulation as well as verbal and spatial memory skills in humans.

Prof. B.K. Anand and his colleagues observed a preponderance of alpha waves in the EEG of yogis, indicating a more relaxed state of mind.[33] He also observed that sensory stimuli, such as a loud bang or an ice-cold/hot object, which normally blocks the alpha rhythm, could not do so in yogis during meditation. This indicates that the yogis do not get easily distracted by sensory stimuli while they are meditating.

Power spectral analysis of 24-h EEG in those who have been practicing Transcendental Meditation (TM) has shown an increase in the alpha/delta power and a decrease in the beta/alpha power indicating a reduction in time spent sleeping and more relaxed mind during the awake period. Further, it was found that there was a better balance and synchrony in the EEG recorded from the left and right side, and from the frontal and occipital leads. This has been interpreted to indicate enhanced creativity. This neuroplastic changes is associated with positive feelings such as joy, happiness, and low levels of anxiety.[34] *Kapalbhati* Pranayama calms the mind, it benefits with mood swings and minor anxiety, promotes psychological well-being, induces sleep, and corrects sleep disorders.[35]

Conclusion

Kapalbhati (Kapal: skull or frontal head and *Bhati*: shining) *pranayama* reverses the pattern for breath control *(Vyutkrama)*. Most *pranayamas* stresses muscular control during inhalation, but in *kapalbhati,* exhalation is active and forceful using abdominal muscle contractions but inhalation is natural and passive. *Kapalbhati* is initially energizing, cleansing (expulsion of carbon dioxide), and heating (there occurs parasympathetic withdrawal and sympathetic activation during *pranayama*). There is an increase of gamma wave activation post *pranayama* showing control of the default mode network. *Kapalbhati pranayam* helps to convert deoxygenated venous blood to oxygenated blood, thereby purifying the blood and improves oxygen saturation. It helps to improve concentration and reduce abdominal fat, tones the abdominal muscles, and improves mood producing a relaxing effect on the individual.[20,36-41] It massages the organs of abdomen, increases concentration, increases heart rate, blood circulation, strengthens lungs, and removes congestion in nasal passage and lungs, and improves pulmonary function. It may be used to help patients with asthma, polyovarian cystic disease, MS, obesity, attention deficit, and sleep disorders.[42-47]

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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