Original Article

Immediate Effect of Yoga Pranic Energisation Technique (YPET) on Heart Rate Variability and Pulmonary Function in Healthy Individuals – A Randomized Control Trial

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ABSTRACT

Background: Pranayama are effective in improving autonomic and respiratory variables in Healthy and diseased individuals. Prana is one of the important in Pancha Pranas which regulates the function of the heart and lungs. Hence, we planned to conduct the effect of Yoga Pranic Energisation Technique (YPET) on heart rate variability (HRV) and pulmonary function (PF) on healthy individuals. **Materials and methods:** 250 subjects were screened from this 70 were randomly allocated to a study group (n = 35) for 30-minute YPET intervention and control group (n = 35), who received supine rest during. HRV and PF tests were assessed at baseline and immediately 5 minutes after the intervention. **Results:** There were no baseline differences across all parameters between the two groups. No significant difference was observed between group $p > 0.05$ in heart rate variable parameters. There was a significant increase in average RR ($p = 0.003$) and Standard deviation of all the R-R intervals ($p = 0.004$), with significant decrease in heart rate ($p = 0.004$) in the YPET group with only significant change of average RR ($p < 0.001$) was observed in control group. In pulmonary function test, there was a significant difference between the groups in forced expiratory volume in one second / Forced Vital Capacity (%) ($p < .02$), FVC ($p < .001$), and FEV1; $p < 0.001$. **Conclusion:** The study shown that practice of YPET could be beneficial in improving parameters of Heart rate variables and lung function parameters among healthy individuals.

Key words: Yoga Pranic Energisation Technique (YPET), Pulmonary function test, Heart rate variability, Prana, Yoga

Ancient Indian philosophy is where the fundamental base of yoga first emerged [1]. The word "yoga" origin from a Sanskrit term "yuj" which signifies unity, union of individual soul with universal soul [2, 3]. Yoga roots as the oldest traditional practice dating back to 3000 years, now in the Western world being considered as a holistic approach to health and as a form of complementary and integrative medicine [2]. Patanjali introduced philosophy and practices in his famous treatise the yoga sutras. Many people in the current day, believe that yoga is solely about asanas, but he introduces 196 sutras, which mentions about practicing of asana, pranayama, dharana & dhyana (meditation) with the incorporation of sounds & lifestyle changes [4].

Patanjali has given several mind-body breath practices in the name of Ashtanga yoga, including Bahiranga yoga like Yamas, Niyamas, Asana, Pranayama and Antaranga Yoga like Dharana, Dhyana, and Samadhi. Pratyahara (withdrawal of senses) is a transition between Bahiranga and Antaranga yoga [2, 5] that enables mind control. The modern psychosomatic diseases were described in the concepts of Pancha Kosha and Adhi/Vyadhi [5]. According to study the classic Yoga Vasishta [5, 6], psychosomatic disorders arise in the mind (Manomaya Kosha), permeate to subtle energy known as the vital life-force (Pranamaya Kosha), and rooted in the physical body (Annamaya kosha) and damage the most susceptible organ by affecting their physiology and function. When the mind is continually disturbed, the vital life-force (varistha prana) in the body is disrupted by breath imbalances, causing dysfunction in the five life-force channels like Prana, Apana, Samana, Udana, and Vyana [5].

The Yoga-based Pranic Energisation Technique (YPET) is an advanced yoga relaxation practice that utilizes Prana Shakti (life energy) to revitalize the entire body. This technique integrates breath control, chanting, and, visualization to harmonize and energize the physical aspects of the body [7]. Prana is one crucial component among the five vital energies (pancha pranas), and regulates the functioning of heart and lungs. It governs the life force responsible for respiration, circulation, and maintaining the vitality of the body [5]. This

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process proves to rejuvenate every system of the body including all the organs. Its significance lies in its potential to enhance functioning of the immune system, which may help in healing modern life-threatening diseases such as cancer, AIDS, chronic fatigue syndrome, and more. In YPET, all five pranas are activated, with Vyana primarily utilized for energization and revitalization. According to the Prashnopanishat, prana is the fundamental force from which everything in the universe is formed.

Typically, prana cannot be felt unless an individual possesses heightened sensitivity and a corresponding deep state of relaxation. Therefore, YPET is a systematic technique that trains the practitioner to perceive prana, beginning with breath awareness and gradually progressing from the simpler to the more subtle aspects, allowing the practitioner to connect with the subtle, previously unknown energies [8]. Pranayama is a Sanskrit term that combines two words: "prana," meaning "breath of life" or "vital force," and "ayama," meaning "expansion," "regulation," or "control." Therefore, pranayama refers to the practice of controlling and expanding the vital energy or breath within the body [9, 10].

Numerous positive health effects of pranayama including stress reduction, cardiovascular benefits [11], increased respiratory function [12], and improved cognitive performance [13]. Pranayama practices helps improve parasympathetic activity, which improves heart rate variability, [14, 15] and improves breathing capacity by improves chest wall expansion and forced expiratory lung volumes [15, 16]. There were no studies published on role of YPET on heart rate variability and respiratory parameters, hence we have planned to conduct immediate effect of YPET on heart rate variability, and pulmonary function on healthy individuals. This study focusses to examine whether YPET significantly improves the lung function in healthy individuals. To examine whether YPET significantly improves the heart rate variability in healthy individuals.

MATERIAL AND METHODS

This was an Open labelled, single center, two-arm parallel group, Prospective Randomized Control trial. Comparing the YPET on pulmonary function and Heart rate variability among healthy individuals with control group receive Simple supine rest. The study was conducted form February 2024 to May 2024 at the Holistic health Centre at the southern part of India. The study was approved by Ethics Committee, and registered using (Clinical Trials. gov identifier CTRI/2023/11/060104). Participants provided written informed consent.

Sample size is calculated by using G power 3.1.9.4 by considering 1:1 allotment ratio with 75% power, 5% level of significance with effective size of 0.7. The total sample size was found to be 60. At least 70 subjects will be recruited for the experiment in order to account for the potential loss of power due to a maximum of 10% dropout rate. The participants including both males and females who were aged between 18 to 25 years were selected subject to their interest to participate. The BMI range was set to 18-29.9 kg/m2. The students who are habituated to nicotine and alcohol, debilitated individuals and subjects under medications were excluded from study population [7]. The people with any systemic illness or with any recent surgeries within the recent 6 months and having a pacemaker were also filtered out. The Subjects were invited to participate in the study by phone calls. Patients who were interested in the study and eligible for the study were further called for a screening visit. Fig. 1 presents participant flow by group. After screening, 70 patients were recruited and randomly assigned to study group (YPET) (n = 35) or control group (Supine rest) (n = 35). Randomization was done using chit Randomization method. When 4 - 6 subjects were recruited, they were randomized to study or control group with a 1:1 allocation ratio and allocations were kept in sealed envelopes.

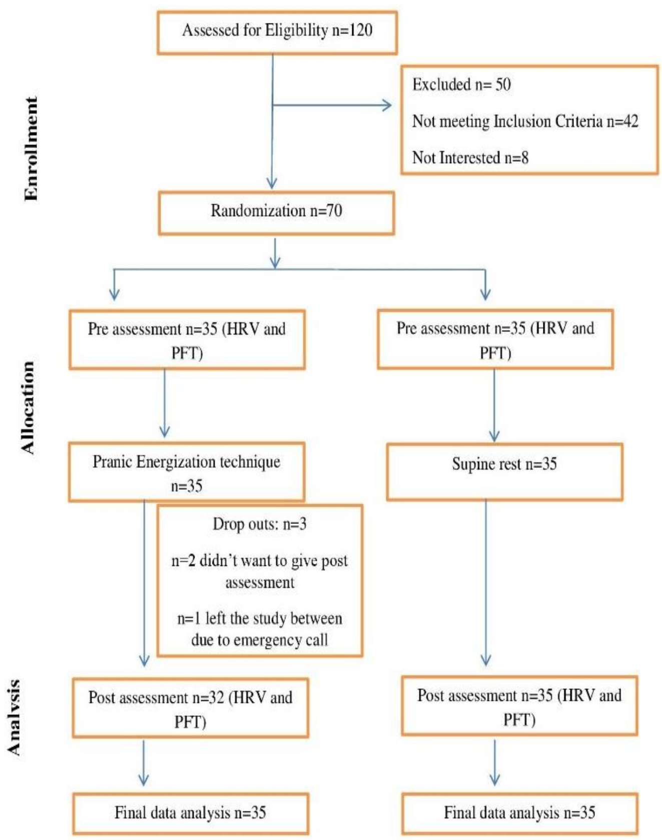

Figure 1: Consort flow chart

Intervention: Yoga Pranic Energisation Technique performed on study group.

The YPET was conducted to see the immediate effect for 25 - 30 min in department of Yoga Therapeutics. It was administered by a trained yoga physician. YPET is an advanced yoga relaxation technique in which we use our prana shakti to energize our entire body and was developed by SVYASA.

Importance will be its utility for strengthening the immune defense so that the modern dreaded killers – cancer, AIDS, Chronic fatigue syndrome, etc. can be effectively healed.

Step 1 - Prayer: **Pranasyedam vase sarvam,** **Tridive yat pratisthitam** **Mateva putran raksasva** **Srisca prajnanca vidhehi na iti**
Step 2 - To sense the prana, being relaxed Phase I: Relax the lower limbs all the way up to the navel. Take a deep inhalation and chant AAAA. Repeat 5 times. Feel the vibration and guide them to impacted region. Phase II: Now, let body relax from abdomen up to neck. Take deep breath Inhale and chant UUU. Repeat 5 times. Feel the vibrations and guide them to the affected area. Phase III: Now, relax the head and all sense organs in the face. Inhale deeply and chant MMM. Repeat 5 times. Feel the vibrations and guide them to the affected part.
Step 3 - Breath awareness & balancing by Nadisuddhi pranayama, Kapalabati
Step 4 - Awareness of nerve impulses, Vyana & Circulatory System & their movement, by Mudras: Cin, Cinmaya, Adi & Namaskara mudras. Chin mudra: Gently touch the tip of your thumb to the tip of your index finger. Used in association with abdominal breathing. Chinmaya mudra: Press the tip of the forefinger on the tip of thumb as in Cin mudra. Fold the middle, ring and small fingers inwards and pressing the palms. This is associated with Thoracic breathing. Adi mudra: pressing the thumb into the palm and closing the fingers around it to form a fist. This is associated with Clavicular breathing. Namaskara mudra: pressing the palms together at the center of the chest. Used to greet elderly people and also in prayer.
Step 5 - Scanning rotating and moving prana to recognize & correct the imbalances.
Step 6 - Expansion of prana to cosmic forces & energizing the immune defence system by the power of mind.
Step 7 - Resolve
Step 8 - Balancing the prana by movement of hand on eyes, temples, eardrum, earpit, throat pit, chest, navel & Namaskara mudra.
Step 9 – Shanti mantra (Share bliss with all). Sarve bhavantu sukhinah Sarve santu niramayah Sarve bhadrani pasyantu Ma kascit duhkha bhaghbgavet [17]

Recorded audio tape was used for the session. Whole session was practiced in Supine position.

For the control group of students, Supine rest was given for 30 minutes. The participants in the CG were advised to practice supine rest for the same duration, i.e., 30 min in Shavasana, as recommended in the Hatha Yoga Pradipika—with their hands facing the roof and their eyes closed [18].

Outcomes: Outcomes were evaluated at two time points: baseline (T_0) and immediately after 5 minutes of the intervention (T_1).

Heart Rate Variability: The ECG will be recorded using a standard bipolar limb lead II configuration, which will be digitized using an 8-bit analog to digital converter at a sampling rate of 1 kHz and was analyzed offline to obtain the HRV spectrum. The Lab Chart 8 (AD Instruments, Australia) tool, which employs the Lomb-Scargle Periodogram algorithm, will be used to analyze the HRV data in both the frequency domain and time domain. Electrocardiogram (ECG) and respiration will be recorded using 8 – a channel human physiology system (Power Lab 8/35, AD Instruments, Australia) The ECG was acquired using the limb Lead II system [14] i.e., the electrodes were placed on the right arm and both legs. The digitized ECG data were analyzed offline to obtain the heart rate variability (HRV) spectrum [19].

Pulmonary Function test: Spirometry is a recommended procedure for diagnosis of lung function [20] . The measures will be assessed with the use of Contac SP 10 handheld Spirometer. An affordable and practical approach to monitoring pulmonary function [21,22]. It is used to find out the following measures.

1. Forced vital capacity (FVC) will be expressed in liter.
2. Forced expiratory volume at 1 second (FEV1) will be expressed in liter.
3. Forced expiratory flow (FEF25-75%) and peak expiratory flow (PEF) will be expressed in liter/second.

Maneuver will be repeated three times during each measurement and the highest reading among all three acceptable readings will be considered as the final value of that sitting [23].

Statistical analysis

The normality of the data was assessed using Shapiro-wilk test. We expressed data in mean ± standard deviation. Effect of intervention was analyzed using paired Student's t-test and Wilcoxon signed-rank for within group comparison and independent t test and Mann-whitney U test for between group comparison based on data distribution. We used the jamovi project (2022); jamovi (Version 2.3) software for statistical analysis. $p < 0.05$ was set as statistically significant.

RESULTS

The present study aims to assess the effect of YPET on heart rate variability and pulmonary functions on healthy individuals. Out of the 250 subjects that were screened, 120 were enrolled in the trial because they matched the eligibility criteria. In the end, 70 people were divided into two groups by randomization:

YPET (n = 35) and control group (n = 35). The final analysis included 70 participants in total 35 participants from both groups. The trial was conducted between February 2024 and May 2024 and involved subject recruitment, randomization, evaluations, and intervention. The trial ended after completion of expected study samples. Baseline characteristics were shown in **Table 1.**

Table 1: Baseline characteristics of the subjects in the YPET and control groups.

Variable	Study group (SG)	Control (CG)	Group
Age	23.06 ± 1.24	22.60 ± 2.05	
Height (cm)	165.34 ± 12.40	163.66 ± 9.66	
Weight (Kg)	64.00 ± 13.58	62.31 ± 12.24	
BMI (Kg/m^2)	22.95 ± 2.87	22.67 ± 2.39	
SBP (mm Hg)	119.43 ± 11.66	117.49 ± 4.79	
DBP (mm Hg)	76.63 ± 4.60	75.14 ± 4.35	

Data expressed mean ± SD. BMI: Body mass index, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, SD: Standard deviation

Heart rate variability

No significant difference was observed between group p > 0.05. There was a significant increase in average RR (p = 0.003), and SDRR (p = 0.004), with significant decrease in heart rate (p = 0.004) in the YPET group with only significant change of average RR (p < 0.001) was observed in control group as shown in **Table 2.**

Table 2: Heart rate variability in YPET and control group

Variable	YPET		Within group	Control Group (CG)		Within the group	B/w Group
	Pre	Post		Pre	Post		
	Mean ± SD	Mean± SD	P value	Mean± SD	Mean± SD	P value	P value#
Average RR	824 ± 96.13	849.95 ± 87.41	0.003$^{\#}$	799.50 ± 111.11	832.24 ± 111.32	<0.001†	0.37
SDRR	53.93 ± 17.58	61.94 ± 17.85	0.004$^{\#}$	51.44 ± 20.87	55.14 ± 17.74	0.086	0.08
Average rate	73.94 ± 8.02	71.78 ± 6.87	0.004$^{\#}$	76.38 ± 9.95	73.46 ± 9.17	<0.001†	0.44
SD rate	4.71 ± 1.29	5.17 ± 1.38	0.02*	4.70 ± 1.43	4.86 ± 1.45	0.362	0.27
RMSSD	50.80 ± 24.07	55.17 ± 21.79	0.120	49.97 ± 26.66	52.03 ± 23.26	0.344	0.52
LF power (ms2)	955.10 ± 727.97	1349.32 ± 1229.18	0.036	913.97 ± 1249.28	1018.20 ± 879.56	0.402	0.19
HF power (ms2)	1265.95 ± 1253.66	1448.45 ± 1276.19	0.139	1384.14 ± 1504.50	1595.90 ± 1636.39	0.159	0.24
LF power (nu)	44.44 ± 18.26	49.25 ± 18.34	0.028	40.55 ± 15.87	42.31 ± 17.07	0.509	0.8
HF power (nu)	61.58 ± 38.40	50.12 ± 18.17	0.118	57.18 ± 15.38	56.57 ± 16.03	0.814	0.8

*p<0.05, $^{\#}p$<0.01, †p<0.001, SDRR; Standard deviation of all the RRSSD; Root mean square of successive difference, LF Power; Low frequency power, HF power; High frequency power

Pulmonary functions

There was a significant difference between the groups in FEV1/FVC (%); p < 0.02. Also, the significant improvement was observed only in YPET group of FVC; p < 0.001 and FEV1; p < 0.001 as shown in **Table 3**.

Table 3: Pulmonary function test in YPET and control group

Variable	YPET		Within group	Control Group (CG)		Within the group	B/w Group
	Pre	Post		Pre	Post		
	Mean ± SD	Mean± SD	P value	Mean± SD	Mean± SD	P value	P value#
FVC	3.07 ± 0.632	3.21 ± 0.697	<0.001†	2.94 ± 0.609	2.95 ± 0.667	0.79	0.12
FEV1	2.77 ± 0.658	2.89 ± 0.696	0.001	2.72 ± 0.593	2.69 ± 0.614	0.14	0.2
FEV1/FVC	89.22 ± 6.725	89.30 ± 6.118	0.68	91.43 ± 8.326	92.38 ± 7.230	0.16	0.02*
PEF	6.61 ± 1.644	6.78 ± 1.554	0.26	6.33 ± 2.269	6.24 ± 2.209	0.37	0.05
FEF 25-75	3.32 ± 1.050	3.41 ± 1.021	0.05	3.62 ± 1.352	3.68 ± 1.475	0.32	0.54

*p<0.05, $^{\#}p$<0.01, †p<0.001, FVC: Forced Vital Capacity, FEV1: Forced expired volume in 1 second, PEF: Peak expiratory flow rate, FEF 2575: forced expiratory flow at 25–75%

DISCUSSION

The present randomized controlled trial was conducted to assess the effect of YPET on heart rate variability and pulmonary function in healthy individuals. This is the first-ever study that was done to assess the effect of YPET on HRV, and PFT on healthy individuals. The study has not shown a significant difference between the groups in heart rate variability but has shown significant improvement in average RR and SDRR, with a significant decrease in heart rate in the YPET group, with only a significant change in average RR was observed in the control group.

The previous studies done on pranayama have shown that the practice of pranayama has a significant decrease in SBP, DBP, and heart rate [24, 25] due to deep breathing in a pranayama practice leading to a reduction in stress. As a result, there is a decrease in sympathetic arousal, which lowers adrenaline secretion. Additionally, the lungs' stretch receptors are stimulated, which raises the Hering-Breuer inflation reflex, which suppresses sympathetic tone and causes vasodilation and parasympathetic nervous system activation [24].

The present study did not demonstrate a significant improvement in HRV parameters between the groups. However, a significant improvement was observed within the groups. In comparison, a previous study focusing on Nadishodhana and Bhramari pranayama reported no significant intergroup improvements but noted a significant decrease in SBP and DBP within the groups. Regarding the time domain of heart rate variability, the prior study showed a significant increase in RMSSD, median RR intervals, and pRR50. In the frequency domain, there was an insignificant increase in HF, along with decreases in VLF and LF. Additionally, a significant reduction was observed in the LF/HF ratio [24].

In our study, LF (nu) showed a significant change with $p < 0.01$ within the YPET group, indicating a parasympathetic influence. Supporting this finding, a study conducted by Rajam Krishna Subramanian and colleagues on alternate nostril breathing (ANB) demonstrated an improvement in LF, which is a marker of parasympathetic dominance. Their results showed an increase in LF soon after the practice of ANB, highlighting its role as an autonomic modulator of heart function [26].

HF reveals the parasympathetic predominance of the heart, while LF/HF reflects the sympatho-vagal balance. In contrast, LF (nu) is interpreted as a sign of sympathetic activity, even if parasympathetic influence also reflects LF value [27]. Another study demonstrated by Changjun Li et al. has shown that the practice of controlled slow breathing at the rate of 8 and 16 breaths/min has shown that, compared to 16 breaths per minute, corrected spectral analysis showed an increase in HF power, decreased LF power, and an LF/HF ratio of HRV in 8 breaths per minute in essential hypertension, and also there was also a shifting of sympatho-vagal balance towards vagal activities and an increase in baroreflux sensitivity [28].

The study, which was published on the reflective instant effect of Kapalabathi on short-term heart rate variability in healthy subjects, has suggested that there was immediate reduction in parasympathetic activity soon after practicing kapalabhathi pranayama; the recovery period showed a greater parasympathetic domination in the pranayama group subjects [29]. Another study has shown that the practice of kapalabhati has improved vagal tone and also improved working memory [30].

In this present study, there was no statistically significant difference among two groups in the pulmonary function test ($p > 0.05$), except FEV1/FVC (%) and PEF, which have shown statistically significant results. But there was a statistically significant result found in FVC, FEV1, and FEF 25-75 within the group. The study published by P. Shyam Karthik and his colleagues on pranayama and suryanamskara on pulmonary function among medical students for 30 minutes daily for 2 months has shown that there was significant improvement seen in all parameters of lung function parameters [16].

The pranayama techniques employed in PET, such as Kapalabhati and Nadishodhana pranayama, assist in balancing the nostrils and ensuring oxygen reaches every cell in the body, thereby enhancing oxygenation [17]. The Kapalabhati technique trains individuals to effectively engage the diaphragm and abdominal muscles by performing rapid, forceful exhalations in succession while contracting these muscles. Additionally, it helps clear bronchial secretions, thereby opening the airways in the respiratory system and improving alveolar function [16].

A previous study done by Iffath Jahan et al, has shown that practice using alternate nostril as a breathing exercise has shown that there was an improvement in respiratory parameters FVC, FVE1 and PEFR in experimental group [31]. They found that improvement in FVC is due to strengthening of respiratory muscles by regular breathing exercises [15], FEV1 might get improved because of removal of bronchial secretion, which improves alveoli to get more air through the practice of deep breathing [31]. PEFR improved due to involvement of lung alveoli during breathing exercise [32]. PEFR was expected to increase due to the increased production of prostaglandin and surfactants; which causes the smooth muscle of the larynx and tracheobronchial tree to reflexively relax, and therefore reduce the airway resistance [31, 33].

To our best knowledge, this was the first-ever study to be conducted for assessing the effect of YPET on heart rate variability and pulmonary function. Depending on previous literature, we hypothesize that, through the practice of YPET, we can improve HRV and lung function parameters. As due to a smaller sample size and duration of the study, the subjects were also very few, and the subjects were healthy, collegegoing students. Hence, we couldn't see the statistically significant changes in heart rate variability parameters except in a few parameters like average RR, SDRR, and heart rate in the YPET group, but we could see the improvement in the FEV1/FVC ratio between the subjects and statistical improvement of FVC and FEV1 only in the YPET group.

Future perspective: Larger robust randomized controlled trial with longer duration is needed to explore the effect of YPET on HRV and PFT among healthy individuals. As our study limited to healthy individuals in future study can be done with the aim to see the efficacy of YPET on specific Psycho-somatic diseases like Essential hypertension, Bronchial Asthma, Anxiety neurosis, Depression.

CONCLUSION

The present study which was shown that practice of Yoga pranic energisation technique (YPET) could be beneficial in altered autonomic variable and lung function in healthy individuals.

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