

Effect of a Combined Sheetkari Pranayama and Physical Exercise Intervention on Stress and Blood Pressure in women.

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Abstract

Introduction

Stress and elevated blood pressure are important factors affecting physical and psychological well-being. Non-pharmacological approaches involving yogic breathing and physical activity may contribute to stress management and cardiovascular health. The present study aimed to examine the effect of Sheetkari Pranayama combined with mild physical exercise on stress and blood pressure among women aged 35–45 years.

Objectives

To assess the outcome of the impact of Sheetkari pranayama on the stress and blood pressure.

Methodology

Thirty women aged 30–45 years were recruited and divided into a study group (n = 15) and a control group (n = 15). The study group participated in a 30-day intervention consisting of mild loosening exercises, brisk walking, and 15 minutes of Sheetkari Pranayama. The control group did not receive the prescribed intervention during the study period. Blood pressure was assessed at six-day intervals, with measurements recorded before and after the breathing practice. Stress was assessed using a standardized stress questionnaire at 14-day intervals. Changes in blood pressure and stress scores were compared between the study and control groups.

Results:

Following the 30-day intervention, changes were observed in systolic blood pressure, diastolic blood pressure, and stress scores in the study group. The changes were compared with those observed in the control group to determine the effect of the intervention. Statistical analysis was performed to assess the significance of changes in the selected variables.

Conclusion:

The findings suggest that a 30-day program combining Sheetkari Pranayama, brisk walking, and mild loosening exercises may have beneficial effects on stress and blood pressure among women aged 35–45 years. The intervention represents a simple, accessible, non-pharmacological approach that may contribute to improved psychological and cardiovascular well-being.

Keywords: Sheetkari Pranayama, stress, blood pressure, pranayama, brisk walking, women, yoga, non-pharmacological intervention.

1. Introduction

Nowadays, in this modern era, people of all age, gender groups are experiencing increasing mental pressure and psychological burdens. Even seemingly simple external pressures and minor tensions can accumulate over time and results to a serious health condition known as stress. Stress has become a common type of disease which can be seen nearly in all people in every type of population. According to WHO (World Health Organization – March 2026) defined stress as a state of worry or mental tension caused by a difficult situation's far as we know that stress is also a natural human response which promote us to face challenges and threats in our life. The way we handle the stress is the biggest concern, where each and every one does choose a different way. Yet, experiencing stress in an extended degree may influence emotional, mental as well as the physical reaction.

It effects and influences of human health and development [17] and research evidence shows that stress is an individual, transactional experience triggered when an environment's demands

exceed a person's resources [2]. While short term stress can boost the activities and focus. Stress effects our body where the heart rate gets manipulated and the physiological response as termed as "Flight or Fight" gets activated. This response is mainly related to the autonomic nervous system – Sympathetic nervous system, which indirectly effects of the cardiovascular function [18]. It also leads to potential engagement in risky behaviors for the heart and results to the stimulation of the neuro endocrine system which is a part of the autonomic nervous system [8]. The autonomic nervous system consists of two divisions where sympathetic nervous system is associated with inducing the heart rate, tensed body situations which is exactly like the stressed conditions and the parasympathetic nervous system which is stated as the state of rest and relaxed where the Blood pressure is normal. Thus the state where the sympathetic nervous system get kicked on the endothelial dysfunction and it shows increased peripheral microvascular tone and vasoconstriction of the coronary artery [4], which leads to effect the heart function and HRV. While in the state of sympathetic nervous system, it induces the release of the hormone called cortisol which gives signal to the body and goes through the inflammatory changes on response of stress [1].

Yoga introduces a lifestyle which can alter the life in a good way. Yoga has a separate practice of breathing exercises which is known as pranayama. The 4th limb of Ashtanga yoga is comprises of different types of breathing exercises as well. Using pranayama as an option of non -pharmacological treatment to reduce the stress condition is a proven one [14]. Conscious breathing while exhalation slowly or controlled can induce the vagal outflow and its restoration happens which leads to the slowing down of the heart rate [5]. On the basis of CIM approaches, yoga is recognized its easier accessibility, low risk, low side effects and very good benefits on reducing the stress and restoring the mental health in a holistic way [3]. The impact of slow breathing does effects the shift in the direction of the sympatho-vagal response, which does effects the HRV level. [6]. And this effects the body to induces the parasympathetic nervous system and make the body in the state of rest and relaxes the body as well as mind and it influences the vagal activity and energy conservation, rest, relaxation of the whole system [19]. And the presence of low parasympathetic activity considered as the low cortisol, relaxed and normal blood pressure level as well [10]. Sheetkari pranayama, the pranayama itself means cooling pranayama which induce the vagal nerve and induce parasympathetic nervous system which results in reduction in the blood pressure level ultimately relieves the stress [5]. It effects the vagal nerve and induces the parasympathetic nervous system, which leads to the normalization of the elevated heart rate as well as the blood pressure. Studies had shown that, practice of this specific pranayama can regulate the Autonomic modulation. It appears to be effective by the modification in tone of the sympathovagal nervous system and relieve the elevated systolic blood pressure (SBP) among hypertensive patients as well as decreasing the sympathetic nervous system effect [11, 16].

1.1. Objectives

- To assess the baseline level of stress and blood pressure among women aged 35–45 years in the study and control groups.
- To determine the effect of the 30-day intervention on systolic blood pressure in the study group.
- To determine the effect of the 30-day intervention on diastolic blood pressure in the study group.
- To assess changes in perceived stress levels following the 30-day intervention.
- To compare changes in systolic and diastolic blood pressure between the study and control groups.
- To compare changes in stress levels between the study and control groups

1.2. Hypothesis

Null Hypothesis: There will be no significant difference in systolic blood pressure, diastolic blood pressure and stress level between the women who undergo the prescribed training protocol, mild exercise, brisk walking and Sheetkari pranayama.

Alternative Hypothesis: There will be a significant difference in systolic blood pressure, diastolic blood pressure and stress level between the women who get the intervention of, mild exercise, brisk walking and Sheetkari pranayama.

2. Methodology

2.1. Participants

Participants were recruited through simple screening, where free stress score sheet were filled up and assessed by talking to the sample. The samples were collected at Murrumpuzha, Thiruvananthapuram, Kerala and taken 35 – 45 years old females who are active. A total of 30 women were recruited from the population as for the study, where 15 are treated as study group getting the yoga practice and remaining 15 are treated as the control group without giving any practices. Eligible candidates were taken an informed signed consent form in English and Malayalam. The study was approved by the Institutional Ethical committee and done according to the Helsinki Declaration of 1975, which is revised in 2000.

2.2. Variables

Independent variable: Sheetkari pranayama, mild exercises, Brisk walking for 30 days for 30 minutes per day.

Dependent variable: Systolic blood pressure (mmhg), diastolic blood pressure (mmhg), Stress score (DASS 42)

2.3. Inclusion criteria

- Women who are the age of 35 to 45 years old.
- Participants who are willing to take part in this study for 30 days.
- People who have elevated blood pressure and medial stress symptoms.
- Participants who are willing to perform the training protocol and giving the requirement measurements for the study.
- Participants who provide written consent form before participating in the study.

2.4. Exclusion criteria

- Pregnancy
- Severe cardiovascular condition and psychiatry issue.
- Taking medication for blood pressure, diabetes or steroid medicines.
- Current participants in another study.
- Participants who are unable to follow the training protocol.
- People who are suffering from recent injuries (musculoskeletal), surgery, delivery are excluded.

3. Procedure

The study was a randomized controlled clinical trial with interventions and taking the values as are and posttest method. The principal investigator itself is the researcher and the yoga trainer who had administered the yoga interventions to the selected group. Recruited samples were randomly divided into 2 groups Study and control group with each 15 members in it. Group 1 – were the study group which was given the practice of Sheetkari pranayama, mild physical exercise and brisk walking for 30 minutes every day for 7 days a week.

3.1. Interventions

Group 1 – participants were given the Sheetkari pranayama, mild physical exercises and brisk walking, which is taught by the researcher herself. Every day for 7 days a week, 30 days in a month, the study group practiced the scheduled training with guidance of the researcher herself.

30 minutes of practice were given taken the outcome as well. Participants were doing the exact same training protocol and the group-2, control group were untouched and not given any intervention and suggested to lead their usual normal lifestyle.

Training Protocol

Sl no.	Intervention	Procedure
1	Neck Stretch	Stand straight. Both hands on the hip. Slowly stretch the neck backwards with eyes opened. Inhaling stretches the neck back and exhaling bend the neck forward.
2	Shoulder Rotation	Place the both hand on the shoulder while standing upright. Now rotate the both shoulder in clockwise direction and anticlockwise direction as well
3	Hands up & down	Stretch your both hands up in the air close enough to your ears and down it to normal
4	Hip rotation	While standing, place the both hands on your hip and slowly start to rotate in the clockwise direction and anti-clockwise direction.
5	Knee bend	Bend your right knee backward while standing and hold it with the respective hand, and release it slowly to the ground now do the same to the left knee as well.
6	Ankle rotation	Stand upright and slowly raise the right leg from the ground and balance the whole body on the left leg and slowly rotate the right ankle in clockwise and anticlockwise direction. do the same to the left ankle as well.
7	Toe tightening	Again, raise up the right leg and place the heels on the ground and tight your toes and relax the respective leg you had raised and do the same to the other leg too.
8	Brisk walking	Stand straight and start a walking where the both hands hanging loosely and body straight with conscious and medium pace.
9	Relaxation	Sit on the yoga mat where both legs are stretched forward and relax.
10	Sheetkari Pranayama	Assume in a comfortable seated position (Sukhasana), the normal crossed leg position. Both hands in chin mudra. Roll your tongue and touch the tip of the to the upper palate of the mouth. Clench the teeth together. Now slowly inhale through the teeth for 6 seconds and hold the breath for 3 seconds while closing the mouth and exhale through the nose for 12 seconds. This is one round.

Table:1

Time period of Training Protocol

Sl no	Practice	Counts	Time
1	Neck Stretch	4 ups and 4 downs	10 minutes
2	Shoulder Rotation	10 clockwise and 10 anti-clockwise	
3	Hands up & down	10 hands up and down	
4	Hip rotation	20 clockwise and 20 anticlockwise	
5	Knee bend	4 each on the both legs	
6	Ankle rotation	10 clockwise and 10 anticlockwise on each ankle.	
7	Toe tightening	5 counts of toes tightening in each leg.	

8	Brisk walking	No counts	10 minutes
9	Relaxation	No counts	2 minutes
10	Sheetkari Pranayama	22 rounds	8 minutes

Table:2

Total time period for the practice is 30 minutes.

4. Data extraction and outcome measurements

Data extraction is done with proper tools and compiled in Excel (Microsoft). The data were taken from studies are further went for the analysis purpose.

Outcome measurement were measured as pre and posttest method;

Blood pressure: The blood pressure was taken in a digital Bp Apparatus to minimize the errors. The measurements taken from the blood pressure apparatus were the Systolic blood pressure and diastolic blood pressure which is measured in mm/hg. And was observed in every 6th day before and after the yoga interventions. Thus totally 6 Pretest and 6 posttest raw data were obtained from the study group and 1 test were taken in the 0th day and 30th day each from the controlled group without giving any interventions, giving 2 data in total.

Stress Scale: Stress scale was given as questioner to study group. It was assessed using stress subscale of the Depression Anxiety Stress Scale – DASS -42 which was developed by Dr. Peter F. Lovibond and Dr. Sydney. H Lovibond at the university of New south Wales Australia (1995), each item scored from 0 to 3 [12]. 14 items each assessing Depression, anxiety & stress and official website also confirms that it is self-reported instrument to measure depression/anxiety/stress. From these 42 questions, only 14 questions referring to stress are only taken and distributed to the participants and analyzed the collected score.

For the study group every 14th day scale was given, as a posttest, 0th day will act as the pretest for the 14th day and 14th day will act as the pretest for the 28th day, thus collected 3 data from each sample in the study group. For the control group, only 0th day and 28th without any interventions given and collected randomly.

5. Data Analysis

Extracted data are analyzed with Jamovi 2.6.44 to get the proper results. Data were understood as having no normality which leads to take non parametric test as Wilcoxon signed rank test for understanding the within group and Mann Whitney U test was conducted to assess the results of the 2 groups to find whether it supports the hypothesis.

6. Results

A total of 15 women aged between 35 – 45 years, where divided into 2 groups, study and control respectively. Because of the small sample size and non- normality of some variables, non-parametric tests were administrated in all analysis. The Wilcoxon signed rank test was used to conduct within the group comparison, while Mann Whitney U test was used to conduct two groups comparison and the level of significance is $p < 0.05$ and test was set in one tailed test.

Table:3, represents study group within the group, which is done Wilcoxon signed rank test to understand the before – after effect of the interventions which is given to the study group for reducing the systolic, diastolic blood pressure and stress. The results showed a statistically significant reduction in the SBP from the mean 129mmhg on day 0th to 122mmhg on day 30th ($P = 0.001$) in the pretest mode and on posttest mode the mean reduction 128mmhg to 118mmhg ($P = 0.001$). Similarly, the DBP significantly shows the reduction from 85mmhg to 81.2mmhg in mean value ($P = 0.004$) in pretest and variation also shows between the mean of posttest from 84mmhg to 78mmhg ($P = 0.001$) respectively. Stress score shows a clear reduction from 0th to 28th day mean value 29.1 to 21.9 with $P = 0.001$. The study group analysis shows that yoga

training does have effect in reducing the SBP, DBP and Stress among the study group subjects, where the p value is <0.05.

Table: 4, clearly shows that overall increase in the mean value of systolic blood pressure from 0th day to 30th day, 126mmhg to 129mmhg, while the diastolic blood pressure shows hyping of mean value from 85.1mmhg to 87.3mmhg, 0th day to 30th day respectively. Stress score also shows significant increase in their mean value from 27.5 to 29.5 ,0th day to 28th day respectively. Thus, it can conclude with the within group test that study group with intervention shows overall reduction in their mean value and control group without any practices shows increase in their mean value, concluding that the prescribed yoga practice does have a significant role in reducing the selected variables

Within the group comparison- Study group

Sl no	Variables	Test	day	Mean	Median	Standard Deviation	Wilcoxon p value
1	Systolic blood pressure	Pre test	0	129	130	5.40	0.001
2	Systolic blood pressure	Pre test	30	122	120	3.00	
3	Systolic blood pressure	Post test	0	128	128	5.63	0.001
4	Systolic blood pressure	Post test	30	118	118	2.28	
5	Diastolic blood pressure	Pre test	0	85	85	3.23	0.004
6	Diastolic blood pressure	Pre test	30	81.2	80.0	3.12	
7	Diastolic blood pressure	Post test	0	84	84	3.66	0.001
8	Diastolic blood pressure	Post test	30	78	79	2.78	
9	Stress	-----	0	29.1	28	2.17	0.001
10	Stress	-----	28	21.9	22	2.00	

Table:3(Study Group)

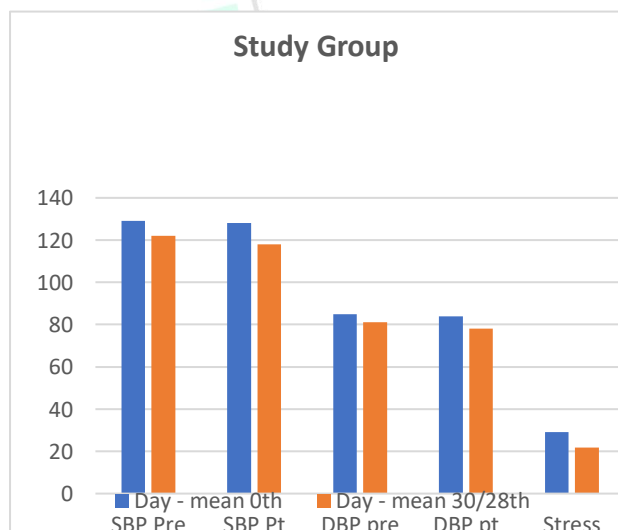


Chart-a

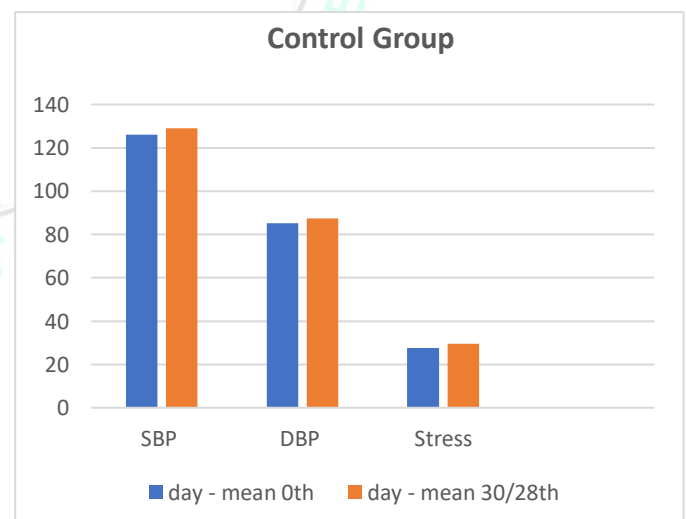


Chart-b

Within the group comparison- Control group

Sl no	Variables	day	Mean	Median	Standard Deviation	Wilcoxon p value
1	Systolic blood pressure	0	126	125	3.73	0.002
2	Systolic blood pressure	30	129	129	3.17	
3	Diastolic blood pressure	0	85.1	85	3.36	0.002
4	Diastolic blood pressure	30	87.3	88	2.55	
5	Stress	0	27.5	27	2.03	0.001
6	Stress	28	29.5	29	2.17	

Table:4(control group)

Table:5, shows the comparison two independent group, study and control group respectively with use of Mann Whitney U test. The mean value of SBP, DBP and Stress of both groups of 0th day doesn't show any variation, because it is where no intervention given to study group as well. The p value does show the difference that at 0th day for the 3 variables $p > 0.05$ value. After the intervention of 30 days, the study group shows 118mmhg and control group shows 129mmhg, where it clearly states the fact that, it is due to the yoga practice the study group shows significant reduction in SBP value. Similarly, for DBP also it proves that the prescribed training played major role in decreasing the mean value for the study group. Stress also shows a significant change in the study and control group, where study shows reduction and control shows elevation. The $p < 0.05$ for the comparison of the two groups.

Comparing 2 groups as independent t test – Mann Whitney U test

Sl no	Variables	Group	Day	STD	Mean	Median	U value	P value
1	Systolic blood pressure	Study	0th	5.40	129	130	76.5	0.139
2	Systolic blood pressure	Control		3.73	126	125		
3	Diastolic blood pressure	Study	0th	3.23	85	85	109	0.899
4	Diastolic blood pressure	Control		3.36	85.1	85		
5	Systolic blood pressure	Study	30th	2.28	118	118	0.500	0.001
6	Systolic blood pressure	Control		3.17	129	129		
7	Diastolic blood pressure	Study	30th	2.78	78	79	0.500	0.001
8	Diastolic blood pressure	Control		2.55	87.3	88		
9	Stress	Study	0th	2.17	29.1	28.0	67.5	0.061
10	Stress	Control		2.03	27.5	27.0		
11	Stress	Study	28th	2.00	21.9	22.0	0.500	0.001

12	Stress	Control		2.17	29.5	29.0		
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Table:5(Study and control group comparison)

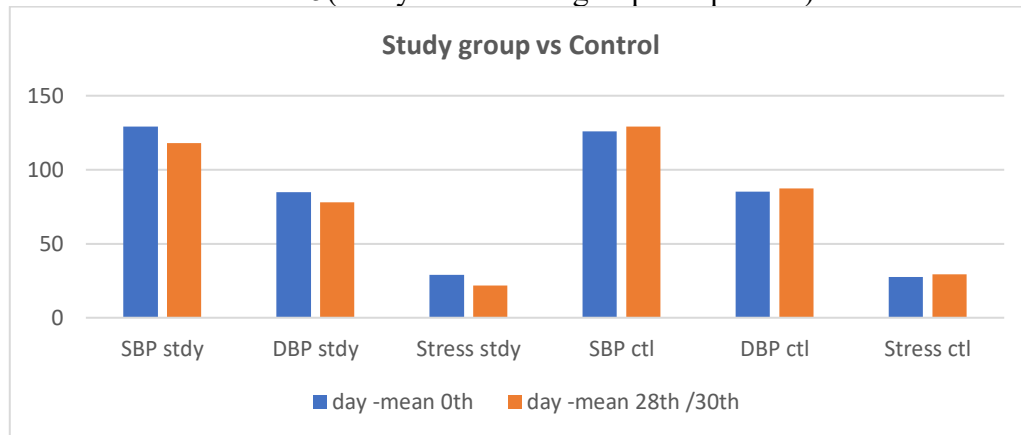


Chart-c

7. Discussion

The present study was conducted to examine the effects of a structured 30day intervention consisting of Sheetkari pranayama, mild exercises and brisk walking on blood pressure and stress score among women aged 35 to 45 years old. The findings of the study demonstrated that significant changes in the systolic, diastolic and stress score in the study and control group, where one shows overall reduction, another shows elevation in the mean value respectively. Within the study group shows significant change which supports the reduction while Wilcoxon signed rank test was conducted. While conducting Mann Whitney U test for the purpose of the comparison of the two groups, study and control, it shows significant changes in the value. However, the statistically baseline differences between the two groups should be considered too. The combined intervention does produce its effect through complimentary mechanism.

Sheetkari pranayama effects the autonomic nervous system and researchers observed, it reduces the systolic blood pressure which leads to the improves HRV an stabilize the overactive nervous system. Regular practice of this cooling effect pranayama significantly increases in the root mean square successive differences between RR intervals (RMSSD) which is the directly related as the time domain index of the cardiac parasympathetic nervous system (PNS) tone [15]. Cooling pranayama also effects the brain waves by calming it and inducing the alpha, delta and theta band power which is present in the frontal and occipital part of the brain, which leads to the reduction of the anxiety [9]. Mild loosening exercises contributes in reducing the stress, by acting as a somatic release which highly effective for reducing the physical tension which built-up during the stressed activity of the mind. Gentle and mild movement is beneficial in breaking the feedback loop of stress activity of the mind by reducing the cortisol and regulating the nervous system which directly results in the production of the mood regulating neuro chemicals which leads to a calm and happy state of the individual [7]. Brisk walking is a moderate intensity aerobic exercise which can be sassily practiced by individuals, which also effects the blood pressure by lowering SBP and DBP by the release of the hormone called Beta-endorphins, which directly results in the reduction of the stress and improve mental well-being [13].

8. Conclusion

The findings from the study suggests that a 30-day program combining Sheetkari Pranayama, brisk walking, and mild loosening exercises have a clear-cut impact on the blood pressure by reducing the sympathetic nervous system through the vagal nerve activation. The study shows the significant reduction in study group which got the intervention Sheetkari pranayama, mild movements and brisk walking as well. It shows that while combining the

mild loosening exercises and brisk walking results in active yet stress free mindset which can promote total well-being. The intervention represents a simple, accessible, non-pharmacological approach that may contribute to improved psychological and cardiovascular well-being among women aged 35- to 45-year-old. Hence this study supports the Alternate hypothesis.

9. References

1. Adam E. K. (2006). Transactions among adolescent trait and state emotion and diurnal and momentary cortisol activity in naturalistic settings. *Psychoneuroendocrinology*, 31(5), 664–679. <https://doi.org/10.1016/j.psyneuen.2006.01.010>
2. Bhargava, D., & Trivedi, H. (2018). A study of causes of stress and stress management among youth. *IRA-International Journal of Management & Social Sciences*, 11(3), 108–117. doi.org
3. Cramer, H., Anheyer, D., Lauche, R., & Dobos, G. (2017). A systematic review of yoga for major depressive disorder. *Journal of affective disorders*, 213, 70–77. <https://doi.org/10.1016/j.jad.2017.02.006>
4. Drexler H. (1997). Endothelial dysfunction: clinical implications. *Progress in cardiovascular diseases*, 39(4), 287–324. [https://doi.org/10.1016/s0033-0620\(97\)80030-8](https://doi.org/10.1016/s0033-0620(97)80030-8)
5. Hainsworth R. (1995). Cardiovascular reflexes from ventricular and coronary receptors. *Advances in experimental medicine and biology*, 381, 157–174. https://doi.org/10.1007/978-1-4615-1895-2_15
6. Hall, M., Vasko, R., Buysse, D., Ombao, H., Chen, Q., Cashmere, J. D., Kupfer, D., & Thayer, J. F. (2004). Acute stress affects heart rate variability during sleep. *Psychosomatic medicine*, 66(1), 56–62. <https://doi.org/10.1097/01.psy.0000106884.58744.09>
7. Hamdani, Usman & Zill-E-Huma, & Zafar, Syed & Waqas, Ahmed & Rahman, Atif. (2020). Effectiveness of relaxation techniques to reduce distress, anxiety and depression in adolescents: An insight analysis report based on systematic review, meta-analysis and qualitative narrative review of literature. 10.13140/RG.2.2.21982.36168
8. Hornstein C. (2004). Ansiedad, estrés y enfermedad cardiovascular: un abordaje interdisciplinario [Stress, anxiety and cardiovascular disease: an interdisciplinary approach]. *Vertex (Buenos Aires, Argentina)*, 15 Suppl 1, 21–31.
9. Jagadeesan, Thanalakshmi & Rajan, Ravindran & Sembulingam, Prema. (2014). Impact of Sheethali and Sheethkari Pranayama on the Topographic Mapping of the Brain Waves. *IOSR Journal of Pharmacy (IOSRPHR)*. 4. 51-57.
10. Kim, H. G., Cheon, E. J., Bai, D. S., Lee, Y. H., & Koo, B. H. (2018). Stress and Heart Rate Variability: A Meta-Analysis and Review of the Literature. *Psychiatry investigation*, 15(3), 235–245. <https://doi.org/10.30773/pi.2017.08.17>
11. Kumar, Naveen & K, Mahesh & Allu, Aadhyanth & Jagadeesan, Thanalakshmi. (2021). The immediate effect of Sheethali and Sheethkari Pranayama on blood pressure and cardiovascular changes among hypertensive patients Production and Hosted by. *International Journal of Research in Pharmaceutical Sciences*. 9. 1249-1252.
12. Lovibond, P.F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy*, 33(3), 335-343
13. Malem, R., Ristiani, R., & Ali Puteh, M. (2024). Brisk Walking Exercise Has Benefits of Lowering Blood Pressure in Hypertension Sufferers: A Systematic Review and Meta-Analysis. *Iranian journal of public health*, 53(4), 774–784. <https://doi.org/10.18502/ijph.v53i4.15554>
14. Michalsen, A., Jeitler, M., Brunnhuber, S., Lüdtkke, R., Büssing, A., Musial, F., Dobos, G., & Kessler, C. (2012). Iyengar yoga for distressed women: a 3-armed randomized

- controlled trial. *Evidence-based complementary and alternative medicine : eCAM*, 2012, 408727. <https://doi.org/10.1155/2012/408727>
15. Sharpe, E., Lacombe, A., Sadowski, A., Phipps, J., Heer, R., Rajurkar, S., Hanes, D., Jindal, R. D., & Bradley, R. (2021). Investigating components of pranayama for effects on heart rate variability. *Journal of psychosomatic research*, 148, 110569. <https://doi.org/10.1016/j.jpsychores.2021.110569>
 16. Shetty, Prashanth & Reddy, B. & Lakshmeesha, D.R. & Shetty, Shiva & Kumar, G. & Bradley, Ryan. (2017). Effects of Sheetal and Sheetkari Pranayamas on Blood Pressure and Autonomic Function in Hypertensive Patients. *Integrative Medicine (Boulder)*. 16. 32-37.
 17. Tost, H., Champagne, F. A., & Meyer-Lindenberg, A. (2015). Environmental influence in the brain, human welfare and mental health. *Nature neuroscience*, 18(10), 1421–1431. <https://doi.org/10.1038/nn.4108>
 18. Vrijkotte, T. G., van Doornen, L. J., & de Geus, E. J. (2000). Effects of work stress on ambulatory blood pressure, heart rate, and heart rate variability. *Hypertension (Dallas, Tex. : 1979)*, 35(4), 880–886. <https://doi.org/10.1161/01.hyp.35.4.880>
 19. Wehrwein, E. A., Orer, H. S., & Barman, S. M. (2016). Overview of the Anatomy, Physiology, and Pharmacology of the Autonomic Nervous System. *Comprehensive physiology*, 6(3), 1239–1278. <https://doi.org/10.1002/cphy.c150037>

Appendix

Stress Score Sheet DASS 42 – Sample sheet for reference, from this only 14 questions are taken exclusively for the stress test. (1,6,8,11,12,14,18,22,27,29,32,33,35,39)

DASS		Name:	Date:
Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you <i>over the past week</i>. There are no right or wrong answers. Do not spend too much time on any statement. <i>The rating scale is as follows:</i> 0 Did not apply to me at all 1 Applied to me to some degree, or some of the time 2 Applied to me to a considerable degree, or a good part of time 3 Applied to me very much, or most of the time			
1	I found myself getting upset by quite trivial things	0	1
2	I was aware of dryness of my mouth	0	1
3	I couldn't seem to experience any positive feeling at all	0	1
4	I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1
5	I just couldn't seem to get going	0	1
6	I tended to over-react to situations	0	1
7	I had a feeling of shakiness (eg, legs going to give way)	0	1
8	I found it difficult to relax	0	1
9	I found myself in situations that made me so anxious I was most relieved when they ended	0	1
10	I felt that I had nothing to look forward to	0	1
11	I found myself getting upset rather easily	0	1
12	I felt that I was using a lot of nervous energy	0	1
13	I felt sad and depressed	0	1
14	I found myself getting impatient when I was delayed in any way (eg, elevators, traffic lights, being kept waiting)	0	1
15	I had a feeling of faintness	0	1
16	I felt that I had lost interest in just about everything	0	1
17	I felt I wasn't worth much as a person	0	1
18	I felt that I was rather touchy	0	1
19	I perspired noticeably (eg, hands sweaty) in the absence of high temperatures or physical exertion	0	1
20	I felt scared without any good reason	0	1
21	I felt that life wasn't worthwhile	0	1

Reminder of rating scale:

- 0 Did not apply to me at all
- 1 Applied to me to some degree, or some of the time
- 2 Applied to me to a considerable degree, or a good part of time
- 3 Applied to me very much, or most of the time

22	I found it hard to wind down	0	1	2	3
23	I had difficulty in swallowing	0	1	2	3
24	I couldn't seem to get any enjoyment out of the things I did	0	1	2	3
25	I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0	1	2	3
26	I felt down-hearted and blue	0	1	2	3
27	I found that I was very irritable	0	1	2	3
28	I felt I was close to panic	0	1	2	3
29	I found it hard to calm down after something upset me	0	1	2	3
30	I feared that I would be "thrown" by some trivial but unfamiliar task	0	1	2	3
31	I was unable to become enthusiastic about anything	0	1	2	3
32	I found it difficult to tolerate interruptions to what I was doing	0	1	2	3
33	I was in a state of nervous tension	0	1	2	3
34	I felt I was pretty worthless	0	1	2	3
35	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
36	I felt terrified	0	1	2	3
37	I could see nothing in the future to be hopeful about	0	1	2	3
38	I felt that life was meaningless	0	1	2	3
39	I found myself getting agitated	0	1	2	3
40	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
41	I experienced trembling (eg, in the hands)	0	1	2	3
42	I found it difficult to work up the initiative to do things	0	1	2	3