OPEN ACCESS
Freely Available Online

OpenAccessPub

INTERNATIONAL JOURNAL OF PSYCHOTHERAPY PRACTICE AND RESEARCH

ISSN NO: 2576-612X

Research Article

DOI: 10.14302/issn.2574-612X.ijpr-20-3213

Impact of Himalayan Singing Bowls Meditation Session on Mood and Heart Rate Variability

Saharsh Panchal[1], Fariburz Irani[2], Gunjan Y Trivedi[3,*]

[1]Public Health Specialist, Intern, Society for Energy & Emotions, Wellness Space, Ahmedabad, India

[2]Psychology Major, School of Liberal Studies, PDPU and Intern, Society for Energy & Emotions, Wellness Space, Ahmedabad, India

[3]Co-founder, Society for Energy & Emotions, Wellness Space, Ahmedabad, India

Abstract

Introduction: Scientific evidence has established the benefits of meditation and sound vibrations on emotional and physiological health.

Aim of the Study: The study explored changes in mood and Heart Rate Variability (HRV) after HSB Sound Bath Meditation on healthy individuals. The objectives of the study were to understand if a 40-minute-long seated HSB Sound Bath Meditation results in changes (a) in mood measured via Positive And Negative Affect Scale (PANAS) and Abbreviated Profile of Mood States (POMS) Survey and (b) in physiological parameters, as measured by HRV.

Methods: The psychological parameters were measured with PANAS (N=77) and Abbreviated POMS, (N=17). The physiology was measured with HRV parameters such as Heart Rate (HR), Stress Index (SI) and Root Mean Square of Standard Deviation (RMSSD) using the EmWave Pro device (N=15). HRV data analysis was conducted with Kubios HRV Premium and analyzed using a paired T-Test.

Results: All the subjects after meditation showed improvement in Positive Affect (PA) and a reduction in Negative Affect (NA). The HRV parameters showed a trend showing overall relaxation with a significant reduction in HR, SI and an increase in RMSSD. Consistent with changes in positive, negative mood and HRV, all the participants showed a reduction in tension, anger, fatigue, depression and confusion and improvement in esteem related affect and vigor.

Conclusion: The findings show that seated HSB Sound Bath Meditation session has a positive impact on mood-related measures and physiology. Future work in this area could explore comparison with a control group and a longer study duration comprising multiple sessions.

Corresponding author: Gunjan Y Trivedi, Co-founder, Society for Energy & Emotions, Wellness Space, Ahmedabad, India, Email: gunjan@wellness-space.net

Keywords: Singing Bowl, Himalayan Singing Bowls (HSB), Meditation, Sound Bath Meditation, Heart Rate Variability (HRV), Stress, Mood, Emotions, Sound Healing

Received: Feb 15, 2020 **Accepted:** Mar 13, 2020 **Published:** Mar 23, 2020

Editor: Elbaih zico, Suez Canal University, Ismailia, Egypt.

Introduction

Scientific evidence has demonstrated the negative impact of emotional stress on the mind and the body [1, 2]. Stress doesn't just impact the nervous system and endocrine system but also results in the impairment of the immune system, cognitive function and an increased risk for chronic disease [3, 4]. One pathway impacted by stress is the autonomic nervous system, specifically, increased activity of the sympathetic nervous system (fight-or-flight) and decreased activity of the parasympathetic nervous system (rest-digest) [5, 6]. Meditation, in general, has demonstrated a significant positive impact on the nervous system, i.e. parasympathetic nervous system, thereby, reducing overall stress [7]. Studies of the meditation practices (especially, mindfulness-based stress relaxation), Yoga Nidra (A form of Yogic relaxation), and singing bowl meditation show a significant impact on the mood and overall well-being, with improved physiological homeostasis and reduction in anxiety and stress [8, 9, 10, 11, 16, 13].

Many ancient cultures use sound as part of prayers, rituals, meditative practices or other activities. This includes the use of instruments such as Gongs, Singing Bowls, Bells, Didgeridoo or human voice in the form of mantra or just simple vibrations as in case of Yogic practice of Bhramari Pranayama. Research in the area of singing bowls has also reported a positive impact on the psychological and physiological parameters [12, 13]. The physics of Singing Bowls and Gongs have been reported in various papers to understand the mechanism involved [14, 15]. There is an opportunity to enhance the understanding of the impact of singing bowls on the mind and the body.

Review of literature identified the opportunity to study the mind-body impact of a seated meditation session with Himalayan Singing Bowls. Earlier studies have either focused only on the psychological measurements or worked with subjects in supine positions and even compared with a control group (silence) [16, 13]. Most of the studies involved 60 minutes long sessions with only one study measuring the impact of a short duration session of around 20 mins [16]. The psychological impact of the previous research indicates some inconsistency with one study showing a decrease in both positive affect and negative affect using PANAS while demonstrating a reduction in heart rate and blood pressure and another has shown a reduction in Positive Affect while combining sound with relaxation though both studies show a reduction in negative moods [13, 18]. This indicates an opportunity to understand the mood changes (including the impact on specific moods) along with physiological changes during a single session of HSB seated meditation [17, 18]. Based on the outcome of this study, further work can focus on the longer term measures with the addition of the control group.

Objectives

The primary objective of the study was to (a) validate that seated single 40 mins long HSB Sound Bath Meditation session has a statistically significant impact on the mood (positive affect and negative affect, as measured by PANAS survey) and (b) physiology (as measured by HRV parameters such as HR, RMSSD, and SI). The secondary objective was to do a preliminary assessment of specific changes in positive and negative affect parameters (as measured by POMS). The study methodology is captured in Figure 1.

Materials and Methods

Participants and Design

This study was conducted across two months at a Wellness Center where free group meditation with Himalayan Singing Bowls is offered twice a month to anyone who is interested. The participants who volunteered to join the study signed informed consent. Ethics committee approval was not required since the free meditation is open to the public and the interventions were non-invasive, consistent with earlier work in this area [13, 18]. A room with good soundproof interiors was used while maintaining 25 Degree Centigrade temperature (Figure 2). This ensured the minimum impact of outside sound and a pleasant indoor temperature. The exclusion criteria included the presence of (a) chronic disease (b) epilepsy (c) pacemaker in the body and (d) metal parts due to any surgery inside the body.

Total 105 subjects signed the informed consent form for PANAS forms, 21 subjects signed POMS form and 20 subjects agreed to undergo the measurements of HRV. Those who agreed for PANAS and POMS completed the self-administered survey 5 minutes before

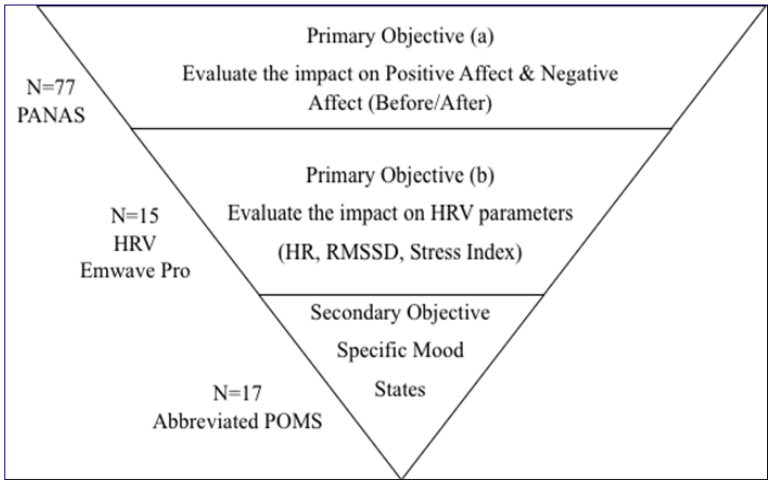

Figure 1. The study methodology

and 5 minutes after the meditation and individuals who agreed to wear the HRV device wore it throughout the meditative practice lasting 40 minutes.

Protocol

The meditation took place from sharp 7:00 PM to 7:40 PM, twice a month and on the dates communicated in advance. The participants were instructed to sit in a cross-legged meditative posture on a meditation chair that provides back support. After completing the signed consent, the participants were given brief instructions specifying the duration of the meditation (exactly 40 mins) and required to focus the attention on the sound vibrations of the singing bowl or observe their breath - especially when their mind gets diverted. The meditation is conducted by a trained therapist with the use of (a) 7 handmade singing bowls ranging from 18cm to 29cm diameter and (b) one Ting-Sha (as shown in Figure 3) [19]. No gongs or other music or sound instruments were used. Participants were instructed to do three humming sounds at the beginning and end of the meditation and throughout the process, they are requested to keep the eyes closed while maintaining the attention on observation of the sound vibrations or their own breath. No other instructions are given. In the beginning, after the three humming sounds, the participants were instructed to follow the session leader's instruction on progressive muscle relaxation (PMR), lasting maximum 3 mins requesting the participants to relax all body parts starting with toes, legs and so on. For the balance of the session, only the sound vibrations of the bowls and Ting-Sha were used, i.e. No more verbal instructions were provided. As mentioned earlier, the sessions ended with three humming sounds. At the end of the session, the participants were requested to slowly observe the changes in the mind and the body and open the eyes when they were comfortable. The lights in the room were closed throughout the meditation. During the mediation, the sound vibrations of the bowl followed a simple pattern of maintaining a gap of about 4-5 seconds between the successive hitting of the bowl and periodically, all the bowls were hit a bit faster to create louder sound from all bowls together (every 8-10 minutes). The bowls were hit by a hammer and the rimming used a wooden stick covered by leather at one end. The entry to the room was closed throughout the practice and air conditioning was maintained at a constant temperature (Figure 2 shows the room). The bowls (shown in Figure 3) were placed in one corner of a long room with a seating capacity of 20 individuals.

Data Measurement & Analysis

The psychological parameters were captured using PANAS and abbreviated POMS forms. The HRV data were collected to measure physiological parameters using the Emwave Pro device (HeartMath, LLC) with PPG (Photoplethysmogram) ear sensor during the entire session. The HRV data was analyzed using Kubios HRV premium software on a Windows 10 PC. The features available in Kubios HRV Premium software (version 3.3.0) were used to export the parameters in a. txt file

Figure 2. The location of the study and the set-up of the bowls

Figure 3. Himalayan Singing Bowls (N=7) deployed for the study

which included Heart Rate, Stress Index and RMSSD. Each .txt file was tabulated and analyzed using Microsoft Excel pivot table. The data was integrated for each of the 5 minutes of the 40 minute long sessions. Microsoft Excel features, specifically function TTEST, were used to do statistical analysis of the data. The analysis used Paired T-test to compare the changes between various intervals for each method (details are captured in the results).

77 out of the 105 subjects who filled up PANAS forms properly were included in the study. 17 participants completed the abbreviated POMS forms to assess Tension (TEN), Anger (ANG), Fatigue (FAT), Depression (DEP), Confusion(CON), Esteem Related Affect (ERA) and Vigor (VIG). All the forms were filled by the participant before and after the meditation and entered into Microsoft Excel sheet for further analysis. 15 participants completed the full HRV recording during the meditation process to measure the physiological parameters like heart rate, and stress index, etc.

Demographics of the subjects and the number of subjects attended the various data collection methods, i.e. PANAS, POMS, and HRV recorded are captured in Table 1.

PANAS is a self-report psychometric questionnaire that can be used across a diverse sample group, measures two segments or moods of an individual. Each segment has 10 terms in which the subject can rate from 1 to 5. Eventually, we can measure the positive and negative affect of the subject before and after any intervention [20, 21]. PANAS has been widely used in the areas ranging from overall mood change in areas ranging from clinical studies involving patients as well as in the areas involving healthy individuals doing various activities such as creative work [22]. PANAS has also been used to measure psychological changes in mood in studies related to meditation and also singing bowls. While PANAS provides valuable insight about the mood, additional validation of the changes in mood via physiological data could add more credibility to the overall conclusion [23, 24]. The abbreviated POMS is a simple and effective self-reported questionnaire to understand changes in specific moods [18]. The expectation was to understand the specific impact on positive and negative mood with the use of PANAS and additionally understand the changes in specific moods with the help of abbreviated POMS.

HRV is a beat-to-beat interval between successive heartbeats (also known as RR or NN interval) and indicates a physiological state. It has been used to evaluate the impact of the singing bowl during supine position[13] [17]. HRV is also emerging as a meaningful marker of autonomic nervous system imbalance, stress, metabolic syndrome and chronic disease. For this study, we used (a) Heart Rate (b) RMSSD (The RMSSD reflects the beat-to-beat variance in heart rate and is the primary time domain measure used to estimate the vagally-mediated changes reflected in HRV) and (c) Stress Index (The Baevsky's stress index is a rather widely used index of cardiovascular system stress and is strongly linked to sympathetic nervous activity). Together, these three physiological measures provide an understanding of the relaxation process as compared to heart rate alone and provide a more comprehensive perspective about the changes in the autonomic nervous system. Specifically, changes heart rate and stress index could provide an indicator of the reduction in sympathetic nervous system activity. The increase in RMSSD denotes a pronounced parasympathetic nervous system activity [28].

Results

Pre and post meditation data of PANAS for 77 enrolled participants showed a statistically significant increase in the positive affect (pre=33.25, post=36.26, $p<0.00$) and a statistically significant reduction in the negative affect (pre=19.92, post= 14.21, $p<0.00$) (Table 2).

The above results confirm the primary objective (a) of the study that there is a statistically significant reduction in negative affect and a similar increase in positive affect.

HRV Parameters

Table 3 shows the key HRV parameters captured every 5 minutes during the Seated HSB Sound Bath Meditation for 15 individuals (Mean Age=37.20, SD=12.69). Paired T-Test calculations between the first (0-5 min) and the last interval (35-40 min) of the meditation indicates a statistically significant change in

Table 1. Demographics of the individuals who participated in various measurements

	PANAS			HRV			POMS		
	n	Mean Age	SD	n	Mean Age	SD	n	Mean Age	SD
Male	36	35.53	13.78	9	35.00	13.19	8	29.25	7.83
Female	41	38.49	12.60	6	38.67	12.92	9	35.78	11.13
Total	77	37.10	13.16	15	37.20	12.69	17	32.71	10.13

Table 2. PANAS Change in Positive Affect and Negative Affect for all participants with * denoting statistically significant changes (for both PA and NA).

n	Mean PA Before	SD PA Before	Mean PA After	SD PA After	p-value PA*	Mean NA Before	SD NA Before	Mean NA After	SD NA After	p-value NA*
77	33.25	7.42	36.26	6.80	0.00	19.92	6.68	14.21	4.08	0.00

Table 3. Changes in key HRV parameters during the meditation (* denotes a statistically significant change in the parameter during 35-40 min as compared to 0-5 min, despite the use of PMR during 0-5 mins).

Time	Mean HR*	Mean RMSSD*	Mean Stress Index*
0-5 min	79.99	38.17	11.53
5-10 min	79.08	36.48	12.42
10-15 min	78.06	40.12	12.58
15-20 min	77.81	40.29	12.24
20-25 min	77.56	39.69	11.75
25-30 min	77.07	42.62	11.27
30-35 min	76.44	44.79	10.98
35-40 min	78.17	55.98	9.65

(a) Heart Rate (b) RMSSD and (c) Stress index. As captured earlier, the Baevsky's stress index is a rather widely used index of cardiovascular system stress and is strongly linked to sympathetic nervous activity [16]. Hence, reduced Heart Rate and Stress index indicate a statistically significant reduction in sympathetic nervous system activity. The RMSSD reflects the beat-to-beat variability in heart rate and is the primary time domain measure used to estimate the vagally-mediated changes reflected in HRV [28]. The trend of these key parameters is shown in Figure 4. These results indicate (a) overall stress level increases in the early part of the meditation and eventually begins to reduce after about 15 mins and continues the downward trend, consistent with other changes i.e. an increasing trend in RMSSD (b) overall heart rate, however, continues to reduce every 5 minute interval. From statistical perspective, the p-value of Heart Rate, RMSSD and Stress index show statistically significant changes when we compare the last 5 minutes of the meditation with the first 5 minutes. A significant increase in RMSSD denotes a likely increase in parasympathetic tone while a reduction in heart rate and stress index indicates a likely decrease in the sympathetic tone of the participants - when we compare the first 5 minutes with the last 5 minutes. The trend (Figure 4) also validates this.

The above results confirm the primary objective (b) of the study that there are statistically significant changes in physiological i.e. HRV parameters towards the end of the meditation as compared to the beginning.

Abbreviated POMS

Analysis of Abbreviated Profile Of Mood States (POMS) questionnaire show all specific variables except vigor show a significant difference between pre- and post-meditation (Table 4). All the negative moods show a statistically significant decrease while Esteem Related Affect shows statistically significant improvement. Vigor score showed an increase, however, it was not statistically significant ($p=0.31$). A possible explanation for why Vigor could be that while meditating, people are likely to become increasingly relaxed. Moreover, the intervention does not provide any guided imagery that could cause excitement and active feeling. These could be the reasons why we believe that Vigor may have not increased significantly.

Discussion

The study explored the mind-body impact of a single session of seated HSB sound bath meditation. The results indicate significant changes i.e. reduction in negative affect and an increase in positive affect. Unlike the previous study, this study method has generated a positive trend in PANAS with an increase in PA and a decrease in NA[18]. It is likely that a longer duration intervention may have contributed to the positive impact on the mood since as shown in Figure 4, the HRV changes during the initial 15 minutes indicate some activation of sympathetic activation due to an increase in stress index along with a decrease in RMSSD. However, after the initial 15 minutes, the overall trend in HRV has changed denoting an increase in parasympathetic nervous system activity along with a decrease in sympathetic activity. While this trend in HRV data does not directly explain the changes in the mood, it still shows a more relaxed body which may have triggered the beneficial changes in the mood.

The findings are significant since both the mind and the body changes are positive and demonstrate a significant psychological and physiological benefit of such a session. Such sessions can be very useful for individuals keen to reduce stress and improve overall mood. Applications could also include individuals facing sleep disruption or an inability to relax or generalized anxiety. Such practice, on a regular basis, could speed up the relaxation response, known to have a profound impact on the mind and the body[5]. Some creative possibilities for applying sound bath meditation could include pre-surgery relaxation for subjects as well as health care professionals, individuals suffering from depressive mood, anxiety and so on.

Conclusions

This study demonstrates a significant psychological and physiological impact of a 40 min long seated Himalayan Singing Bowls meditation, validated not just through a questionnaire, but also using Heart Rate Variability measures throughout the session to understand the impact on the overall physiological measurement of stress and autonomic nervous system. This intervention can help in the reduction of anxiety

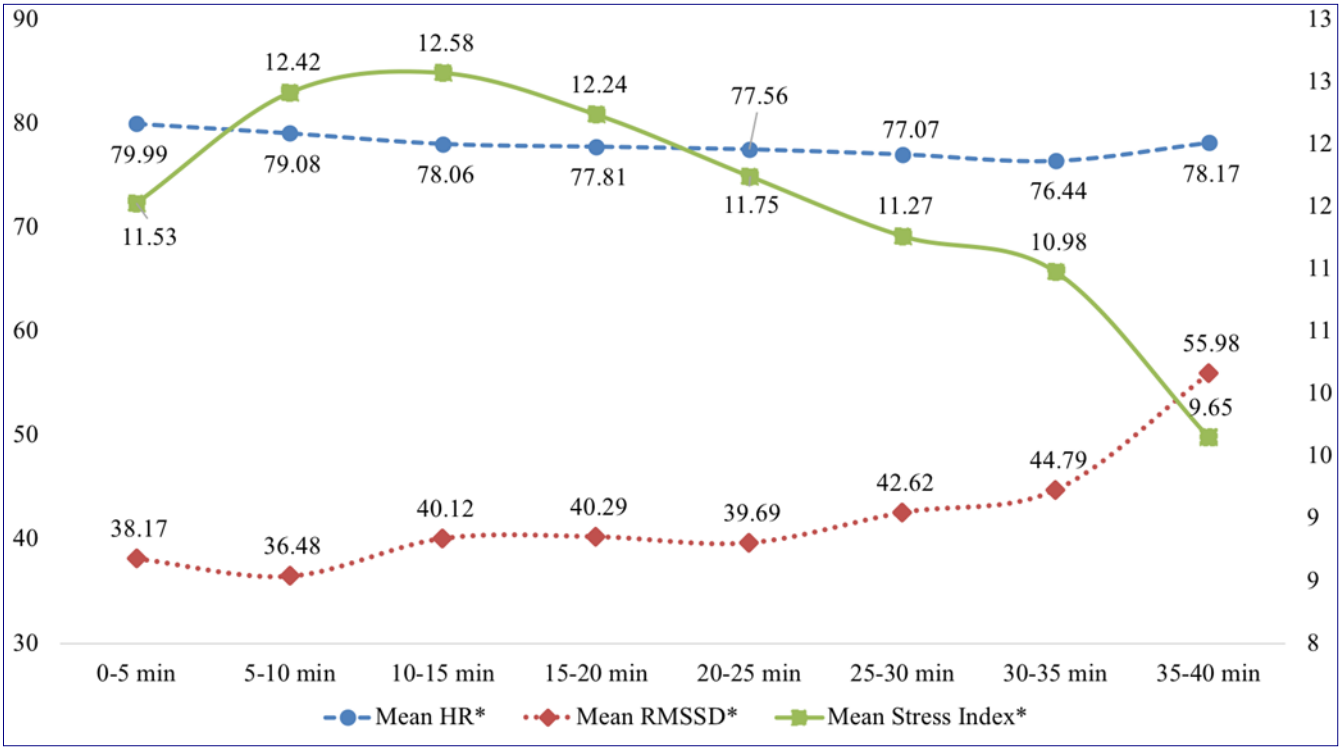

Figure 4. Changes in HRV parameters. Parameters with * indicate a statistically significant change (during 35-45 min as compared to 0-5 min). The X-axis shows the time into the meditative practice. Y-axis shows the three parameters, i.e. HR, RMSSD (Primary, left) and Stress Index (Secondary, right)

Table 4. Summary of POMS data before and after meditation. Parameters with * indicate a statistically significant change

		Pre- Meditation		Post- Meditation			
Measures	n	Mean	SD	Mean	SD	% Change	p value
Tension	17	7.06	2.68	3.76	2.75	-47%	0.00*
Anger	17	4.88	3.43	2.12	2.34	-57%	0.00*
Fatigue	17	6.24	3.58	2.41	2.35	-61%	0.00*
Depression	17	6.82	4.45	2.47	2.83	-64%	0.00*
Confusion	17	7.82	4.42	5.12	3.41	-35%	0.00*
Esteem Related Affect	17	14.35	2.74	16.29	2.71	14%	0.01*
Vigor	17	8.00	3.37	8.41	3.00	5%	0.31

and depressive mood and provide mind-body relaxation.

A more detailed study, involving a randomized trial with a control group, would substantiate the long term benefits of such an intervention. Future work could explore if an individual session would be more effective as compared to a group session and whether such intervention would have an equal impact on healthy individuals as compared to individuals who have metabolic syndrome components or chronic diseases such as hypertension or diabetes.

Acknowledgements

The authors would like to acknowledge the help from Mr. Rajan Shah and Mrs. Dhwani Shah of Wellness Space for data management, analysis and Ms. Rene Shah (student volunteer) for help in administering forms.

References

1. Mariotti A. (2015) The effects of chronic stress on health: new insights into the molecular mechanisms of brain-body communication. , Future science OA 1 (3), 1-6.
2. Thoits, P. A. (2010). Stress and health: Major findings and policy implications. Journal of health and social behavior, 51(1_suppl), S41-S53.
3. Salleh, M. R. (2008). Life event, stress and illness. The Malaysian journal of medical sciences: MJMS, 15(4), 9.
4. Segerstrom, S. C., & Miller, G. E. (2004). Psychological stress and the human immune system: a meta-analytic study of 30 years of inquiry. Psychological bulletin, 130(4), 601.
5. Benson, H., & Proctor, W. (2011). Relaxation revolution: The science and genetics of mind body healing. Simon and Schuster.
6. Trivedi Gunjan, Y., Hemalatha, R., & Ramani, K. V. (2018). Chronic Diseases and Mind Body Management, An Introduction (Technical Note), Reference No: CMHS0044TEC. Indian Institute of Management.
7. Goldin, P. R., & Gross, J. J. (2010). Effects of mindfulness-based stress reduction (MBSR) on emotion regulation in social anxiety disorder. Emotion, 10(1), 83.
8. Parker, S. (2019). Training attention for conscious non-REM sleep: the yogic practice of yoga-nidrā and its implications for neuroscience research. In Progress in brain research (Vol. 244, pp. 255-272). Elsevier.
9. Ferguson, K. L. (2016). The effects of a yoga nidra practice on mental health clinicians' perceived stress.
10. Kumar, K. (2008). A study on the impact on stress and anxiety through Yoga nidra.
11. Janssen, M., Heerkens, Y., Kuijer, W., Van Der Heijden, B., & Engels, J. (2018). Effects of Mindfulness-Based Stress Reduction on employees' mental health: A systematic review. PloS one.
12. Bidin, L., Pigaiani, L., Casini, M., Seghini, P., & Cavanna, L. (2016). Feasibility of a trial with Tibetan Singing Bowls, and suggested benefits in metastatic cancer patients. A pilot study in an Italian Oncology Unit. European Journal of Integrative Medicine, 8(5), 747-755.
13. Goldsby, T. L., Goldsby, M. E., McWalters, M., & Mills, P. J. (2017). Effects of singing bowl sound meditation on mood, tension, and well-being: an observational study. Journal of evidence-based complementary & alternative medicine, 22(3), 401-406.
14. Terwagne, D., & Bush, J. W. (2011). Tibetan singing bowls. Nonlinearity, 24(8), R51.
15. Henrique, L., Antunes, J., & Inácio, O. (2004). The physics of Tibetan singing bowls. Revista de acústica, 35(1), 33-39.
16. Trivedi, G. Y., & Saboo, B. (2019). A Comparative Study of the Impact of Himalayan Singing Bowls and Supine Silence On Stress Index and Heart Rate Variability. Journal of Behavior Therapy and Mental Health, 2(1), 40.
17. Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. Journal of personality and social psychology, 54(6), 1063.
18. Grove, J. R., & Prapavessis, H. (1992). Preliminary evidence for the reliability and validity of an

abbreviated profile of mood states. International Journal of Sport Psychology.

19. Gunjan Y Trivedi (author) conducted the meditation and acknowledges the training received from Guru Shree Krishna Shahi, Nepal.
20. Crawford, J. R., & Henry, J. D. (2004). The Positive and Negative Affect Schedule (PANAS): Construct validity, measurement properties and normative data in a large non-clinical sample. British journal of clinical psychology, 43(3), 245-265.
21. Von Humboldt, S., Monteiro, A., & Leal, I. (2017). Validation of the PANAS: A measure of positive and negative affect for use with cross-national older adults. Rev. Eur. Stud., 9, 10.
22. Ding, X., Tang, Y. Y., Tang, R., & Posner, M. I. (2014). Improving creativity performance by short-term meditation. Behavioral and Brain Functions, 10 (1), 9.
23. Barnhofer, T., Duggan, D., Crane, C., Hepburn, S., Fennell, M. J., & Williams, J. M. G. (2007). Effects of meditation on frontal α-asymmetry in previously suicidal individuals. Neuroreport, 18(7), 709-712.
24. Wu, J., Yuan, Y., Duan, H., Qin, S., Buchanan, T. W., Zhang, K., & Zhang, L. (2014). Long-term academic stress increases the late component of error processing: An ERP study. Biological psychology, 99, 77-82.
25. Trivedi, G. Y., Saboo, B., Singh, R. B., Maheshwari, A., Sharma, K., & Verma, N. (2019). Can decreased heart rate variability be a marker of autonomic dysfunction, metabolic syndrome and diabetes?. Journal of Diabetology, 10(2), 48.
26. Shaffer, F., McCraty, R., & Zerr, C. L. (2014). A healthy heart is not a metronome: an integrative review of the heart's anatomy and heart rate variability. Frontiers in psychology, 5, 1040.
27. Kubios Website https://www.kubios.com/about-hrv/.
28. Oda, S., Matsumoto, T., Nakagawa, K., & Moriya, K. (1999). Relaxation effects in humans of underwater exercise of moderate intensity. European journal of applied physiology and occupational physiology, 80 (4), 253-259.