



Original Article

Effect of Heartfulness cleaning and meditation on heart rate variability

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ABSTRACT

Background: Meditation has been a key component of eastern spiritual practices. Heartfulness meditation is a unique heart based system with key practices like cleaning and meditation aided by yogic transmission.

Objective: To study the effects of Heartfulness cleaning and meditation (guided by Heartfulness trainer) on heart rate variability (HRV), blood pressure (BP) and heart rate (HR).

Methods: A total of 30 participants (21 males, 9 females; age range 19–70 years, M = 45.1 years and SD = 12.7 years) participated in the study. HRV, BP and HR were studied before, during and after the three stages of rest, cleaning and meditation.

Results: There was significant effect of cleaning and meditation on normalized unit of power in low-frequency band (LFnu) for the three conditions [F (2, 87) = 9.98, p < 0.01] with mean values for baseline being 70.82 ± 14.55, cleaning being 55.62 ± 15.06 and meditation being 55.17 ± 16.63. There was also a significant effect of cleaning and meditation on normalized unit of power in high-frequency band (HFnu) [F (2, 87) = 7.31, p < 0.01] with mean values for baseline being 30.86 ± 16.51, cleaning being 44.37 ± 15.06 and meditation being 44.83 ± 16.63. Significant effect of cleaning and meditation was also seen for LF/HF [F (2, 87) = 4.98, p < 0.01] with mean values for baseline being 3.45 ± 3.40, cleaning being 1.63 ± 1.30 and meditation being 1.82 ± 2.19.

Conclusion: Heartfulness cleaning and meditation had a positive effect on sympathovagal balance.

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1. Introduction

Meditation has been a key component of eastern spiritual practices for thousands of years. However, it has been recognized as a systematic practice resulting in measurable psycho-physiological effects on the body only during recent years.^{1,2} Meditation is being practiced by many people now as a practical, safe and effective tool to reduce stress and manage their health. There have been several studies on the effects of different types of meditation on various well-being indicators,^{3–6} primarily to gain mechanistic insights into the impact of meditation on the bodily systems. In such studies, one of the frequently used variable has been heart rate variability (HRV), a psycho-physiological parameter which is robust marker of mortality and cardiovascular health. Several studies have clearly shown the salutary effects of meditation on HRV.^{7–11} However, Heartfulness practices and their effect on cardiovascular measures has not been studied yet. It is important to study specific meditation techniques because various

meditation techniques^{12,13} employ different procedures to achieve the desired state of mind. Moreover, processes like cleaning and meditation with yogic transmission are unique to Heartfulness system, which makes it important to study the effect of these processes comprehensively.

Heartfulness cleaning is an active process in which “will power” is used. The practitioner imagines that all the complexities and impurities are leaving his entire system. After some time, he supposes that a current of purity is coming from the source and entering his system from the front. This current is flowing throughout his system, carrying away any remaining complexities and impurities. He finishes with the conviction that the cleaning has been completed effectively.¹⁴ During meditation with a Heartfulness trainer, the practitioner meditates along with the trainer who triggers the transmission (utilization of divine energy for the transformation of human beings) on their behalf as per procedure.¹⁴

As described above, Heartfulness spiritual practice comprises of several different components like cleaning, meditation and prayer. The yogic transmission facilitates the process of meditation, thereby making it easier even for the new practitioner to feel the effects in a very short period of time. Owing to its unique approach,

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ease, simplicity and perceived efficacy by the practitioners, Heartfulness spiritual practice has been gaining popularity worldwide as a refined and modified form of *Raja Yoga* (yoga of mind).^{15–17} Studies have demonstrated the beneficial effects of Heartfulness meditation on physical health, psychological health, emotional intelligence, sleep and even on telomere length.^{18–21} However, there is a gap in literature for studies pertaining to impact of Heartfulness practices on HRV. We hypothesized that the Heartfulness practices of cleaning and meditation would have an impact on HRV. The present study was, therefore, undertaken to study the effects of Heartfulness cleaning and meditation on frequency domain parameters of HRV using Holter monitoring along with the effect on heart rate (HR) and blood pressure (BP). As HRV is a psycho-physiological parameter, closely related to psychological well-being, a few well-being related measures have also been used for assessing baseline level of overall happiness, flourishing and feelings of experiences to make the interpretation of HRV results more meaningful. HRV parameters are indicative of sympathovagal balance which is related to feeling of peace and happiness. Hence a feedback questionnaire has also been used to get subjective ratings of peace, happiness, enjoyment and effort felt by the practitioners during cleaning and meditation processes to support the result as assessed by HRV.

2. Research methodology

2.1. Participants

Thirty three practitioners of Heartfulness spiritual practice volunteered for this study, however, 3 participants had to be excluded due to technical problems in recording their complete data. Finally, 30 participants (21 males, 9 females; age range 19–70 years, $M = 45.1$ years and $SD = 12.7$ years) who had been practicing the Heartfulness system from 1 month to 372 Months ($M = 142$ months and $SD = 112$ months) regularly were included in the study. All the participants were from the NCR region (Delhi, Noida, Gurugram and Faridabad) and had registered voluntarily for the study, in response to the announcements at the local centers of Heartfulness.

2.2. Study procedure

Each participant reported at the Non-invasive Cardiology Laboratory of Max Super Speciality Hospital, Saket, New Delhi, India on the stipulated date. The entire study process was performed in a quiet room and data was collected between 2:00 p.m. and 5:00 p.m. for each participant, in order to control the time of day effects on HRV. All participants were seated in an upright posture on a chair during data collection and each participant was subjected to a standard set of procedures while data was recorded in a computer. No interruptions for food, drink or for any other reasons were allowed during this period. On arrival, each participant was briefed about the procedures to be followed during the study and a consent form was signed by every participant. The Holter monitor (Track smart TS12, DYAUSMED Healthcare, India) was applied on the chest after proper skin preparation (applying 37% spirit and shaving, when required). The 10 electrodes were placed on standard positions (4 limb leads and 6 precordial leads V1–V6) over the heart in the intercostal spaces. The electrodes were secured in place with micropore adhesive to minimize artefacts. The entire procedure was performed in 3 stages of 30 min each, timed by a stop watch. The first stage was the baseline stage where each participant was seated quietly with eyes open. In the second phase (Stage II), the participants performed Heartfulness cleaning and in the third phase (Stage III), the participants performed Heartfulness meditation aided by yogic

transmission under the guidance of Heartfulness trainer. As the first and fourth authors are certified Heartfulness trainers, hence they guided the meditation themselves. The first reading of pulse was recorded by palpation of radial arteries before Stage I from both arms. Since there was no difference in pulse volume between the two sides in any participant, BP was recorded from the left arm using the standard Korotkoff technique with the help of an aneroid manometer (Welch Allyn SN160810173747). The cuff was left in place to make it easier for the next reading. On each occasion of BP recording, a set of two readings was taken at a gap of two minutes and their average was recorded. Same procedure was followed at the end of each stage for recording the pulse rate and BP. During each stage, the Holter recording continued and the data was downloaded at the end of each stage by a trained non-invasive cardiology technician. Finally, the trained technician removed the electrodes and the participants filled up the feedback questionnaire.

2.3. Physiological health parameters for study

Low frequency band (LFnu), high frequency band (HFnu) and the ratio of power in low frequency band to power in high frequency band (LF/HF) were recorded for each stage since these are well studied parameters of sympathovagal balance, recommended for use in studies on the effect of meditation. Minimum Heart Rate (HR_{min}) and maximum Heart Rate (HR_{max}) during each stage were also computed from the data collected during Holter monitoring. Data was analyzed using Smart Track Holter Analyzer Software (make DYAUSMED Healthcare, India).

2.4. Psychological tests used

An assessment of happiness and well-being of participants before starting the Holter test was made. Cantril's Ladder scale, Scale of Positive and Negative Experience (SPANE) and Flourishing scale were used to assess overall happiness and well-being of the participants. Cantril's Ladder Scale of happiness has been used to get overall assessment of happiness of participants. This is important in order to find in which category of happiness the participants fell in general and whether any participant was on extreme of un-happiness. SPANE has been used to get an idea of how participant was feeling with respect to recent past. SPANE covers both negative and positive aspects and it is a very simple and small scale. Flourishing Scale is an indicator of participants' perception of well-being about various aspects of life (i.e. relationships, self-esteem, purpose and optimism). It is to be noted that before Holter monitoring for stages of rest, cleaning and meditation, it was not desirable to use any lengthy or complicated measure, as this would have affected the main processes itself. At the same time, it was important to get overall indication of state of mind and subjective feedback. Details of the above tests are given in following sections.

2.4.1. Cantril's ladder

Cantril's Ladder²² was used to get the overall assessment of happiness of a participant. The question asked was "Taking all things together, how happy would you say you are? Please mark 10 on a scale if you are very happy and 0 if you are very unhappy".

2.4.2. Scale of positive and negative experience (SPANE)

SPANE²³ measures feelings like good, pleasant, happy, joyful, contented, bad, unpleasant, sad, afraid and angry on a scale of 1–5 [from Very Rarely or Never (1) to Very Often or Always (5)]. There are a total of 12 items in the scale. Positive feelings score (SPANE-P, $\alpha = 0.87$), negative feelings score (SPANE-N, $\alpha = 0.81$) and an overall affect balance score (SPANE-B, $\alpha = 0.89$) which is

subtracting the negative score from the positive score are derived from the scale. Cronbach's coefficient for SPANE-P ($\alpha = 0.81$) and for SPANE-N ($\alpha = 0.77$) were found to be acceptable in a study on Indian population.²⁴

2.4.3. Flourishing scale (FS)

The FS²³ is a brief 8-item summary measure of the respondent's self-perceived success in important areas such as relationship, self-esteem, purpose, and optimism. The scale provides a single psychological well-being score. The 8 items are rated on a Likert type rating scale, 1 denoting strongly agree and 7 indicating strongly disagree. Cronbach's alpha ($\alpha = 0.87$) was reported by Diener²³ which is considered to be very good. In a study on Indian population, Confirmatory Factor Analysis (CFA) and an excellent level of Cronbach's coefficient ($\alpha = 0.93$) was reported.²⁴

2.5. Feedback questionnaire

Feeling of peace and happiness is indicative of positive effect on sympathovagal balance. Feedback questionnaire was used to assess peace, happiness, enjoyment and effort felt by the participants during cleaning and meditation processes to support the result as assessed by HRV. Feedback questionnaire consisted of five questions related to the experience during stage II and III (cleaning and meditation). The questions were about how enjoyable, how demanding, how peaceful and how happy they felt after the cleaning and meditation stages respectively. The participants were asked to rate on a scale of 0–10 (where '0' denoted 'not at all' and '10' denoted 'very much') for the first four questions whereas the fifth question was a descriptive one, asking their general feeling about the cleaning and meditation stages.

2.6. Data analysis

Statistical analysis was carried out using SPSS version 16. HRV data obtained from Holter monitor was analyzed using Smart-track Holter analyzer Software (make DYAUSMED Healthcare, India). The one-way Analysis of Variance (ANOVA) was used to compare the HRV data (LFnu, HFnu, LF/HF), HR_{min} and HR_{max} for the three stages. One-way ANOVA was also used for comparing the BP readings taken before starting of the baseline stage and at the end of each of the three stages. The One-Way ANOVA procedure is used to determine whether there are any statistically significant differences between the means of two or more independent groups. Post hoc analysis was done using Tukey's honestly significant difference (HSD) test.

3. Results

Effect of cleaning and meditation on HRV, HR_{min}, HR_{max} and blood pressure are described in following sections. Psychological assessment of participants has also been described.

3.1. Effect of cleaning and meditation on HRV

A significant effect of cleaning and meditation was observed on the three variables of HRV used in the study as compared to the baseline stage. A one-way between-subjects ANOVA was conducted to compare the effects of cleaning and meditation on LFnu, HFnu and LF/HF ratio (Table 1). There was a significant effect of cleaning and meditation on LFnu for the three conditions [F (2, 87) = 9.98, $p < 0.01$]. There was also a significant effect of cleaning and meditation on HFnu [F (2, 87) = 7.31, $p < 0.01$] and on LF/HF [F (2, 87) = 4.98, $p < 0.01$] for the three conditions.

Post hoc comparisons using the Tukey's HSD test indicated that the mean score of LFnu for cleaning (M = 55.62, SD = 15.06) was

Table 1

Measurement of heart rate variability recorded during baseline, cleaning and meditation.

Variables	Baseline	Cleaning	Meditation	F
LFnu	70.82 ± 14.55	55.62 ± 15.06	55.17 ± 16.63	9.98**
HFnu	30.86 ± 16.51	44.37 ± 15.06	44.83 ± 16.63	7.31**
LF/HF	3.45 ± 3.40	1.63 ± 1.30	1.82 ± 2.19	4.98**
HR _{min}	70.00 ± 6.42	67.00 ± 8.15	65.77 ± 7.85	2.52
HR _{max}	97.77 ± 10.01	90.33 ± 8.94	88.80 ± 9.89	7.40**

Note: Values are group mean ± SD.

** Significant at $P < 0.01$, using Analysis of Variance (ANOVA).

significantly different from the baseline condition (M = 70.82, SD = 14.55). Similarly, LFnu for meditation (M = 55.17, SD = 16.63) was significantly different from the baseline condition (M = 70.82, SD = 14.55).

Mean score of HFnu for cleaning (M = 44.37, SD = 15.06) was significantly different from the baseline condition (M = 30.86, SD = 16.51). Similarly, HFnu for meditation (M = 44.83, SD = 16.63) was significantly different from the baseline condition (M = 30.86, SD = 16.51).

Mean score of LF/HF for the cleaning (M = 1.63, SD = 1.30) was significantly different from the baseline condition (M = 3.45, SD = 3.40). Similarly, LF/HF for meditation (M = 1.82, SD = 2.19) was significantly different from the baseline condition (M = 3.45, SD = 3.40).

3.2. Effect of cleaning and meditation on HR_{min} and HR_{max}

There was no significant effect of cleaning and meditation on HR_{min} at $p < 0.05$. However, there was a significant effect of cleaning and meditation on HR_{max} for the three conditions [F (2, 87) = 7.40, $p < .01$].

Post hoc comparisons using the Tukey's HSD test indicated that the mean score of HR_{max} for cleaning (M = 90.33, SD = 8.94) was significantly different from the baseline condition (M = 97.77, SD = 10.01). Similarly, HR_{max} for meditation (M = 88.80, SD = 9.89) was significantly different from the baseline condition (M = 97.77, SD = 10.01).

3.3. Effect of cleaning and meditation on BP

A one-way between-subjects ANOVA was conducted to compare the effects of cleaning and meditation on systolic blood pressure [BP(S)] and diastolic blood pressure [BP(D)] recorded at four points of time (Table 2). There was a significant effect of cleaning and meditation on BP(S) for the four measurements [F (3, 116) = 4.29, $p < 0.01$], however, effect of cleaning and meditation on BP(D) was not significant at $p < 0.05$ level.

Post hoc comparisons using the Tukey's HSD test indicated that the mean score of BP(S) at end of meditation (M = 106.33, SD = 16.50) was significantly different from the baseline condition (M = 119.00, SD = 17.69). However, the BP(S) at end of cleaning and at end of rest was not significantly different from the BP(S) at the beginning.

3.4. Psychological assessment of participants

For happiness assessment using Cantril's Ladder, 4 participants were in the range of 5–7 whereas 26 participants were in the range of 8–10 on the scale of 0–10. Flourishing Score of participants was in the range of 38 to 56 with mean value being 50 ± 4.36 . The possible range of scores is from 8 (lowest possible) to 56 (highest Psychological Well-Being possible). Mean SPANE (P), SPANE (N) and SPANE (B) scores were 25.27 ± 3.31 (range 19–30), 12.77 ± 3.43 (range 6–19) and 12.50 ± 5.81 (range 2–24), respectively. The score

Table 2

Blood pressure recorded at the beginning, at end of rest, at end of cleaning and at end of meditation.

Variables	At the beginning	At End of Rest	At End of Cleaning	At End of Meditation	F
BP(S)	119.00 ± 17.69	119.00 ± 17.69	110.33 ± 15.42	106.33 ± 16.50	4.29**
BP(D)	78.33 ± 10.20	78.33 ± 10.20	75.00 ± 11.06	72.33 ± 10.73	2.28

Note: Values are group mean ± SD.

** Significant at $p < 0.01$, using analysis of variance (ANOVA).

can vary from 6 (lowest possible) to 30 (highest positive/negative feelings score) for SPANE (P) and SPANE (N) and –24 (unhappiest possible) to 24 (highest affect balance possible) for SPANE B. The present results on happiness scales have shown that all of the participants had sound level of happiness.

Mean scores of response for feedback questionnaire are shown in Fig. 1. For Question 1 (how enjoyable), Question 3 (how peaceful) and Question 4 (how happy), the scores for cleaning and meditation are near 9, which implies “very much”. For Question 2 (how demanding), the scores for cleaning and meditation are near 3, which implies low effort.

4. Discussion

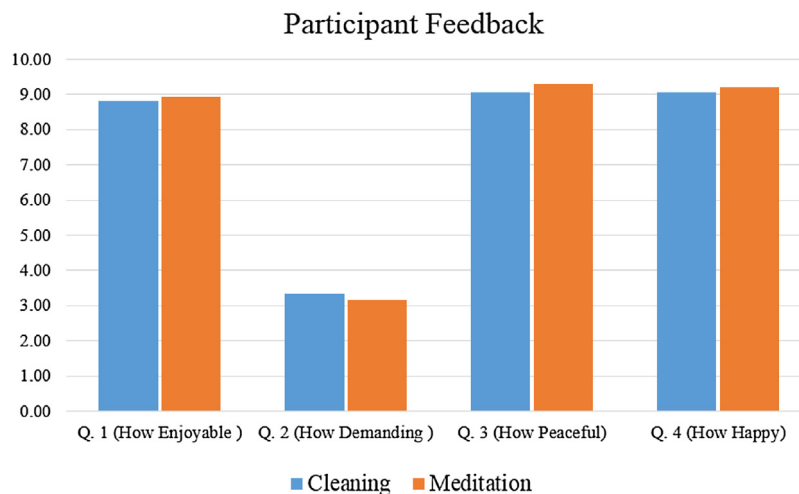
Frequency domain analysis parameters of HRV like LFnu, HFnu and LF/HF are considered to be representative of the autonomic tone. The practice of various types of meditation has consistently shown to increase the parasympathetic tone (increase in HFnu) and reduce the sympathetic tone (LFnu and LF/HF) for the duration of meditation.^{7,11} The analysis of HRV data for these parameters in present study revealed that LFnu and LF/HF decreased whereas HFnu increased during cleaning and meditation, compared to their baseline values, thereby indicating that parasympathetic dominance operated during both these procedures. In a study on effect of inward-attention meditation on parasympathetic activity, LF/HF and LFnu decreased whereas HFnu increased, suggesting the benefit of a sympathovagal balance towards parasympathetic activity in meditators.²⁵ In a systematic review, it was suggested that yoga practices which included compassion meditation, yogic postures and breathing exercises, lead to a better regulation of the sympathetic nervous system and hypothalamic-pituitary-adrenal system, as well as a decrease in depressive and anxious symptoms in a range of populations.²⁶ In another study on mindfulness meditation and HRV, decrease in absolute low frequency power (LF) and increase in high frequency power (HF) was reported.⁷ These studies and

the systematic reviews support the results found in our study with regard to changes in HRV parameters.

In another study, aimed at looking at the sustained effect of the act of meditation, it was observed that meditation practice during the day appeared to shift sympathovagal balance in favor of parasympathetic dominance during sleep on the following night.²⁷ Besides, there are studies which have traced the effects of meditation on the autonomic tone along with the effect on brainwave pattern and sought a correlation between the two. In a study on changes in EEG and autonomic nervous activity during meditation and their association with personality traits, there was an increase in fast theta power and slow alpha power on EEG predominantly in the frontal area, whereas an increase in the HFnu (as a parasympathetic index) and decrease in the LFnu and LF/HF (as sympathetic indices) were observed through analysis of HRV during meditation.⁶

Although results during meditation in the present study are consistent with all the above studies, an interesting and novel aspect is a similar effect observed with the act of cleaning. Cleaning is a unique feature of the Heartfulness system and is considered to be an active process utilizing the will power of the practitioner. It is being demonstrated for the first time that cleaning also results in increase of parasympathetic tone and decrease of sympathetic tone, similar to what happens with meditation. Thus, cleaning and meditation both have been found to be equally effective in terms of modulating autonomic tone.

In the present study, there was a significant effect on HR_{max} due to cleaning and meditation both as HR_{max} values during cleaning and meditation were lower than those during baseline. In a study on finding efficacy of Heartfulness meditation in moderating vital parameters, Heartfulness meditation was found to be effective in moderating average HR, Respiratory Rate (RR) and BP(S). The authors concluded that a 30-min session of Heartfulness meditation produces significant relaxation of the autonomic nervous system and favorably moderates basic vital parameters.¹⁵ In another study on mindfulness meditation, results suggested that

**Fig. 1.** Feedback of participants about cleaning and meditation.

mindfulness practice could promote effective HR regulation.²⁸ These studies support the results obtained about HR_{max} in the present study, further emphasizing the effectiveness of cleaning and meditation.

The effect of cleaning and meditation on BP(S) was significant with values at end of the session being lower than baseline values. However, post-hoc analysis indicated that the significant effect of reduction in BP(S) was mainly during meditation and not during cleaning. Similar reduction in BP(S) due to meditation has been observed in other studies.^{29,30} In a review on whether mindfulness meditation mediates the physiological markers of stress, meditation was found to reduce BP(S). Focused attention meditation reduced cortisol in addition to BP(S). Open monitoring meditation reduced HR as well as BP(S). When all the meditation forms were analyzed together, meditation reduced cortisol, C-reactive protein, BP, HR, triglycerides and tumor necrosis factor-alpha.³¹ Reduction of BP(S) in present study is in line with the findings of other similar studies, supporting further the results obtained by HRV analysis.

Response to the feedback questionnaire by participants indicated that cleaning and meditation were quite enjoyable and made them peaceful and happy. They were found to be very less demanding. In a related study carried out with healthcare providers, results indicated that Heartfulness meditation offers an accessible and efficient method by which physician and nurse burnout can be ameliorated and wellness can be enhanced.¹⁸ Physiological evidence of relaxation during meditation has also been found in another study.²⁹ Feedback response giving subjective ratings, which is in line with other studies, supports the results obtained by HRV analysis. Feeling of peace and happiness is indicative of positive effect on sympathovagal balance as assessed by HRV. An earlier study has also shown that increase in HF-HRV usually occurs in response to positive emotion.³²

Cantril's Ladder score (5–7 for 4 participants, 8–10 for 26 participants) gives overall assessment of happiness of participants. Gallup³³ reported categories of happiness as rating 0–4 slightly happy (suffering – well-being that is at high risk); rating 5–7 moderately happy (struggling – well-being that is moderate or inconsistent), and rating 8–10 highly happy (thriving – well-being that is strong, consistent, and progressing). It seems that the data is skewed positively as the participants are practitioners of Heartfulness. The mean scores of FS, SPANE(P), SPANE(N) and SPANE(B) for participants of this study are better compared to a related study on Indian population on three different samples for validating the FS and SPANE.²⁴ This gives an indication of the sound level of well-being of participants.

A limitation of this study is lack of an independent control group for comparison. Another limitation is lack of follow up assessment to study how long the effect of these practices lasted in terms of the heart rate, BP and HRV related changes observed immediately after the practices. The duration for which these effects last, is an important information and needs to be studied. One more limitation of the study has been that analysis for effect of age and experience could not be examined as the sample size was small which cannot be broken into smaller groups for statistical analysis like ANOVA. Such analysis can be done in future studies with bigger sample size. Similar studies of various other Heartfulness spiritual processes like prayer meditation, group meditation etc. can be done in future with matched control group and larger sample size to draw more meaningful conclusions. Role of several variables like period of practice, age, gender, education etc. can also be explored in future studies.

5. Conclusion

Overall, Heartfulness processes of cleaning and meditation had a positive effect on sympathovagal balance as demonstrated by

significant decrease in LFnu, LF/HF and significant increase in HFnu values. HR_{max} was also found to decrease significantly during cleaning and meditation whereas BP(S) decreased significantly during meditation, indicating overall positive effect of cleaning and meditation. Positive response of participants about how enjoyable it was and how peaceful and happy they felt, supported the results found by HRV analysis.

Conflict of interest

Authors have no conflict of interest.

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