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Original Research Article

Comparative immediate effect of different yoga asana on cardiac autonomic rhythm in healthy young volunteers

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A R T I C L E I N F O

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A B S T R A C T

Modulation of cardiac autonomic tone is a topic of current interest in research because of its association with several cardiovascular autonomic diseases of public health importance. Yoga has proven benefit in balancing the cardiac autonomic tone. This study aimed to explore the intricate mind body mechanisms with special reference to the immediate effect of Padahastasana (PD) and Ardha Chakrasana (AD) on cardiac autonomic nervous system and to quantify the cardiovascular ANS response to different yogic asana.

Materials and Methods: This was a Cross Sectional Study, conducted in autonomic function lab, of department of physiology, AII India Institute of Medical science, Raipur, India. Heart rate variability (HRV) was analyzed on 30 experienced yoga practitioners (EYP) with the average age of 32.9±9.71 year. All participants were healthy. Padahastasana and Ardhachakrasana were used as an intervention to evaluate heart rate variability.

Results: The time domain parameters show significantly increased parasympathetic component (SDNN, RMSSD, and SD2) after Padahastasana and Ardha chakrasana though increase is more after Ardha chakrasana. Interestingly sympathovagal balance was lowered after Padahastasana and increased after Ardha Chakrasana, although not statistically significant. This response may be due to a more increase in parasympathetic components after immediate Ardha Chakrasana.

Conclusion: Our study showed the HRV has good specificity and positive predictive value for the quantifying autonomic response of Padahastasana and Ardha chakrasana. Backward bending is superior to forward bending and should be included in lifestyle intervention to reduce stress and anxiety disorder.

1. Introduction

Cardiac autonomic nervous system (CANS) plays a major role in maintaining and regulating cardiac function, e.g., systolic and diastolic blood pressure and heart rate. Several methods are available to measure CANS, of which heart rate variability (HRV) has been established as a non-invasive tool.[1] Recently, HRV has been proposed as the most sensitive indicator of autonomic function, especially for assessing sympathovagal balance. An imbalance in the rhythm is seen in cardiovascular disorders such as hypertension, ischemia, sudden cardiac death, and cardiac failure.[2]

Numerous studies indicate a strong association between compromised ANS and sudden and non-sudden cardiac death. Lifestyles modification is also increasingly recognized as an essential factor in the treatment prevention and rehabilitation of cardiovascular disorders. One highly popular and currently researched lifestyle modification is Yoga. There has been a growing interest in the field of yoga research. Undue stretching in some yogic asana may do more harm than benefit for heart disease and hypertensive

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and should be performed with caution. However, very little publication has been found in the literature that discusses the immediate effect of specific yogic asana on the HRV.

Therefore we intend to explore the intricate mind-body mechanisms with particular reference to the immediate effect of Padahastasana (PD) and Ardha Chakrasana (AD) on the cardiac autonomic nervous system by using the HRV. These measures would help understand how the CANS respond to different yogic asana.

2. Materials and Methods

The present study was a cross-sectional study, with pre and post-design and conducted in the autonomic function lab of the department of physiology, AII India, Institute of Medical science, Raipur. The Institutional ethics committee approved the study. The study was conducted on 30 healthy male subjects between the age's groups of 18 to 30 years.

The present study participants were the students of the Yoga science department from Pt Ravishankar University Raipur. Written informed consent was obtained from all subjects who were enrolled. All the participants were healthy, normotensive with the normal resting electrocardiogram (ECG). Subjects with cardiovascular, respiratory illness, or other systemic illness, smokers, and alcoholics, exclude from the study. Female participants were excluded as autonomic and respiratory variables with the phases of the menstrual cycle. Based on routine clinical examination, and were not taking any medication. They ate a plant-based diet and were; their yoga experience was between 16 and 72 months, which ascertained from their self-reports. The specific set points to terminate the exercise were the systolic BP ≥ 160 mm Hg and diastolic BP ≥ 100 mm Hg, and heart rate ≥100.

2.1. Study design

The present study was cross-sectional, with pre and post design. The participants were assessed before and after the Padahastasana [P.D.] and Ardhachakrasana [A.D.]. The total duration of the assessment was 12 minutes for each yoga asana. All the participant was made to relax in supine for 15 minutes before data recording. The first 5 minutes of "pre" F.B. and B.B. were followed by one minute of the "during" period when the participants practice the F.B. and B.B. Furthermore, it is followed by 5minutes of "post" F.B. & B.B. The schematic design of the study is shown in Figure 1. Since this study involves understanding the cardiac modulation before and after the F.B. & B.B., no controls were needed. The H.R.V. was measured over the length of recorded E.C.G., as per the guidelines of Task Force (1996), at least 5 minutes of E.C.G. was recorded to quantify Sympathetic and Parasympathetic tone. Moreover, the following instruction was given to the participants: (1) to avoid food preceding two hours of the testing (2) No coffee, nicotine or alcohol 24 hrs before the testing. (3) Wear loose and comfortable clothing. For short term analysis of H.R.V., Resting parameters like blood pressure, heart rate, and respiration were measured after ensuring a rest period of 15min to the patients. H.R.V. was continuously monitored using a lead II electrocardiogram (E.C.G.). E.C.G. and respiration will be recorded on an 8-channel digital physiograph (LabChart, A.D.I., Australia).

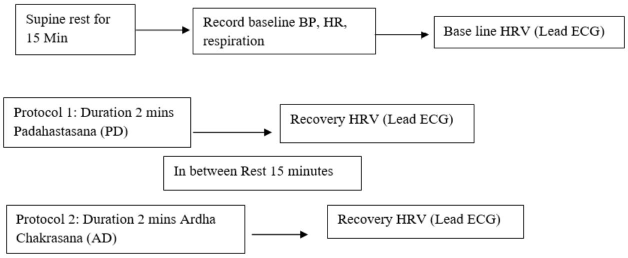

Fig. 1: Study design and signal acquisition

2.2. Intervention

There are two yoga asanas, PD, and AD given to each subject. Intervention time for each asana was one minute, followed by a 10-minute recovery period. The specific set points to terminate the asana were systolic BP ≥ 160 and Diastolic BP ≥ BP 100 mm Hg. And heart rate ≥100. Each asana performed slowly, steps by steps, gradually moving into the final pose and avoid the jerky movement, force, and pressure while performing the asana. The yoga asanas practices are described below.

3. Padahastasana (PD)

1. Stand erect with leg together, inhale, raise the arm sideways
2. Continue to inhale and move the arm upward
3. Exhale bend forward, Rest the palm on the ground while chin touching the knee
4. Maintain the posture for one minute
5. Come up slowly with inhalation and stand erect
6. Relax in standing posture

4. Ardhachakrasana (AD)

1. Stand erect with legs a feet apart
2. Hands on the waist with thumbs facing backwards and rest fingers on pelvic crest
3. Inhale and bend backward.
4. Maintain for a minute with normal breathing
5. Come up and stand erect again
6. Relax in standing posture

4.1. Data collection

Lead ECG was recorded simultaneously along with the beat-to-beat, blood pressure recorded as per guideline of Task Force (1956). The total duration of the recording was 12 minutes for each participant. The total duration was divided into three recording states: 1. The pre-intervention (5 min), 2. Intervention (one min). 3. Post-intervention (5 min). The ECG signal is continuously amplified, digitized, and store in the computer for offline analysis.

5. Data analysis

SPSS 21.0 Version analyzed data. The data for each session were analyzed separately. The frequency domain and time domain components of HRV were analyzed separately for each session. The data were visually inspected off-line, and only noise-free data were included to obtain the heart rate variability spectrum. Two experimental group participants were excluded from the final analysis as data were contaminated at different parts of the record with movement artifact. It was not possible to correct this.

5.1.

5.1.1. Frequency domain analysis

The HRV series' energy for two specific bands was studied, viz. the low-frequency band and high-frequency band. The values of low frequency (LF) and high frequency (HF) were expressed as normalized units. The LF/HF ratio was also calculated.

5.1.2. Time-domain analysis

The following components of time-domain analysis of HRV were obtained: the SDNN (Standard deviation to normal to normal interval); RMSSD (the square root of the mean of the sum of the squares of differences between adjacent NN intervals); SD1; SD2.

Table 1: Mean BMI, weight, & height of the study population

S.No	Parameter	Mean± SD
1	Age (Year)	32.9±9.71
2	Weight(kg)	66.21±9.34
3	Heigh (cm)	169.13±8.58
4	BMI (kg/m)	22.89±1.96

6. Results

6.1. Heart rate variability after P.D.

The frequency and time domain parameters of P.D. are given in Table 1. Using the Mann-Whitney U test, there was no significant difference in the parameter of frequency domain such as LH/HF, L.F. Power, and H.F. power. While the time domain parameters show significantly increased parasympathetic component (SDNN, RMSSD, and SD2) after P.D.

6.2. Heart rate variability after A.D.

The frequency and time domain parameters of A.D. are given in table 2. Using the Mann-Whitney U test, there was no significant difference in the parameter of frequency domain such as LH/HF, L.F. Power, and H.F. power. While the time domain parameters show significantly increased parasympathetic component (SDNN, RMSSD, and SD2) after A.D.

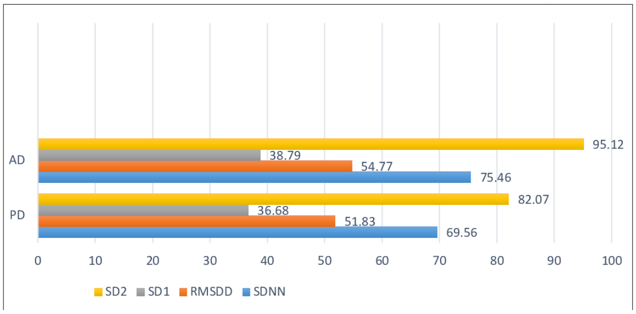

Fig. 2: Time domain analysis after Yogaasans

7. Discussion

We investigated the immediate effect of PD and AD on cardiac autonomic rhythm in healthy individuals [Figure 1]. Young adult participants with experienced yogic exercise and had an average body mass index were included in the study [Table 1].

After the set protocol of yogic exercise PD and AD HRV with standard protocol recorded, the data indicate that time domain parameter such as RMSSD, SDNN, and SD2 show a significantly increased after PD and AD (Figure 2), indicating an immediate increase in the heart vagal components of HRV. After PD, parasympathetic components modulate cardiac autonomic tone but increase less than that of AD.

Interestingly sympathovagal balance was lowered after PD and increased after AD, although not statistically significant. This response may be due to a more increase in parasympathetic components after immediate AD.

Few studies such as Bhavanani et al.[3] reported that Diastolic pressure significantly decreased after performing Janusirsasana (left) compared to vakrasana (right side) at the 6th and 8th min. Janusirsasana is a seating forward bending asana, is according to our finding of an overall decrease in sympathetic tone after yoga asana.

Our study showed the HRV has good specificity and positive predictive value for the quantifying autonomic response of PD and AD. Similarly, Christa E et al.[4] observed in their study in frequency domain indices

Table 2: Heart rate variability after Ardha Chakrasana

Parameters	Baseline (n = 30)	After ArdhaChakrasana (n = 30)	p value
LF/HF (n.u.)	1.053 (0.79-1.30)	1.42 (0.49-1.75)	N. S.
LF power (n.u.)	50.78 (42.52-55.94)	57.07 (28.18-63.26)	N. S.
HF power (n.u.)	48.2 (43.30-56025)	39.94 (36.2-64.6)	N. S.
SDNN (ms)	37.08 (28.26-58.52)	75.46 (65.08-1.7.68)	0.021*
RMSDD (ms)	30.08 (23.07-57.08)	54.77 (41.46-71.15)	0.037*
SD1 (ms)	22.55 (16.54-40.33)	38.79 (29.26-50.42)	N. S.
SD2 (ms)	47.34 (31.38-66.12)	95.12 (83.60-119.2)	0.012*

showed a significant between-group difference in HF power (yoga vs. control: 44.96 [21.94] vs. -19.55 [15.42], p = 0.01) with higher HF power and total power (nu) in the yoga group. It should be noted that these results cannot be generalized to high-risk patients. This short-term yoga-based cardiac rehabilitation program had additive effects in shifting the sympathovagal balance towards parasympathetic predominance while increasing overall HRV in optimally medicated post-MI patients.

Our finding shows backward bending is superior to forward bending and should be included in lifestyle intervention to reduce stress and anxiety disorder; also reported by Chu I.H et al.[5] in his study that a 12-week yoga program was effective in increasing parasympathetic tone and reducing depressive symptoms and perceived stress in women with elevated depressive symptom. Prevesioly Hewett ZL et al.[6] found that a 16-week Bikram Yoga program did not increase the high-frequency power components of HRV.

Sheiko et al.[7] found that respiratory gymnastics yoga for 15 minutes daily contributes to the growth of heart rate variability through the suppression of central link (very-low-frequency components) of regulation of cardiac rhythm and increased the activity of parasympathetic influence, as well as the redistribution of regulatory activity of the central nervous system between the central and peripheral links of regulation of cardiac rhythm in favour of the latter. Although, HRV has used very few studied to quantify the immediate effect of yoga asanas. We proposed that the HRV is an excellent and specific method for the quantifying immediate autonomic response of Padahastasana and Ardha chakrasana. Backward bending is superior to forward bending and should be included in lifestyle intervention to reduce stress and anxiety disorder.

8. Conclusion

AD could be a suitable intervention during cardiac rehabilitation to shift the autonomic balance towards the increased vagal activity. Our finding put forward that AD rouse both limbs of ANS with parasympathetic dominance compared to PD.

9. Source of Funding

None.

10. Conflict of Interest

The authors declare that there is no conflict of interest.

References

1. Malik M. Clinical guide to cardiac autonomic tests. Netherland: Kluwer Academic Publisher; 1998.
2. Ganong WF. Cardiovascular regulatory mechanisms. In: Review of Medical Physiology. USA: Lange Medical Publications; 2003. p. 555–67.
3. Bhavanani AB, Ramanathan M, Balaji R, Pushpa D. Comparative immediate effect of different yoga asanas on heart rate and blood pressure in healthy young volunteers. *Int J Yoga*. 2014;7(2):89–95. doi:10.4103/0973-6131.133870.
4. Christa E, Srivastava P, Chandran DS, Jaryal AK, Yadav RK, Roy A, et al. Effect of Yoga-Based Cardiac Rehabilitation on Heart Rate Variability: Randomized Controlled Trial in Patients Post-MI. *Int J Yoga Ther*. 2019;29(1):43–50. doi:10.17761/2019-00019.
5. Chu IH, Wu WL, Lin IM, Chang YK, Yang PC. Effect of yoga on heart rate variability and depressive symptoms in women: A Randomized controlled trial. *J Altern Complement Med* . 2017;23:310–6.
6. Hewett ZL, Pumpa KL, Smith CA, Fahey PP, Cheema BS. Effect of a 16-week Bikram yoga program on heart rate variability and associated cardiovascular disease risk factors in stressed and sedentary adults: A randomized controlled trial. *BMC Complement Altern Med*. 2017;17(1):226. doi:10.1186/s12906-017-1740-1.
7. Sheiko N, Fekete VP. Dynamics of heart rate variability under the influence, of course, yoga breathing exercise on healthy young people. *Wiad Lek*. 2019;72(4):613–6.

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