Int J Pharm Bio Sci 2013 Oct; 4(4): (B) 120 - 126

Research Article **Neurobiology**

International Journal of Pharma and Bio Sciences **ISSN 0975-6299**

STUDY ON EFFECT OF STRECHING EXERCISES AND PRANAYAMA ON HEART RATE VARIABILITY (HRV) IN HEALTHY VOLUNTEERS

SHANKARAPPA.V* AND PRABHA. V

Assistant professors Department of Physiology, Vinayaka Mission's Kirupananda Variyar Medical College & Hospitals, Salem, Tamil Nadu, India.

ABSTRACT

Background & objective**:**Yoga is a science practiced in India over thousands of years. Besides spiritual achievements, the practice of yoga is accompanied by a number of psycho-physiological beneficial effects in the body. Heart rate variability (HRV) has been established as a non-invasive tool to measure continuous interplay between sympathetic and parasympathetic influences on heart rate and yields information about autonomic flexibility.HRV is commonly described by standard deviation of intervals between successive R waves (SDNN) of cardiac cycle. This study was designed to study the effects of pranayama and stretching exercises on HRV in yoga practitioners.

Materials & methods**:** Study group comprises of 50 yoga practitioners of same socio – economical background and age matched (between 25 –50yrs) in yoga center. HRV was recorded for 5 min in supine position in a quiet room by using (CARDIART 8408 VIEW) HRV machine.

Results: These data obtained were tabulated and statistically analyzed using paired t-test and Pearson's correlation test. HRV after yoga: mean SDNN 0.089±0.039 in yoga practitioners, before yoga SDNN mean 0.0326±0.0071of mean age 45.1±13.13 years. HRV was significantly higher in regular pranayama and stretching exercise practitioners ($p< 0.001$).

Conclusion: There was a statistically significant increase in HRV in regular yoga practitioners indicating parasympathetic dominance. Asanas and pranayama causes cue controlled relaxation and biofeedback shift of autonomic balance towards an increase of vagal activity..

KEY WORDS: Pranayama, yoga,HRV, SDNN.

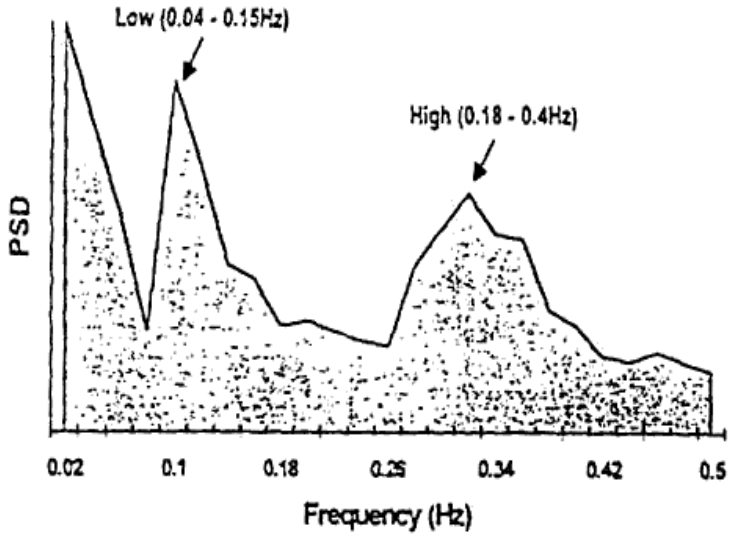
SHANKARAPPA.V
Assistant professors Department of Physiology, Vinayaka Mission's Kirupananda Variyar Medical College & Hospitals, Salem, Tamil Nadu, India.

***Corresponding author**

INTRODUCTION

Yoga is a science practiced in India over thousands of years. Besides spiritual achievements, the practice of yoga is accompanied by a number of psycho-physiological beneficial effects in the body[1]. A high resting heart rate reflects cardiac autonomic imbalance towards sympathetic activity as an independent predictor cardiovascular mortality[2].Several relaxation techniques like Pranayama and some stretching exercises have been established in the management of patients during cardiac rehabilitation aiming to reduce future cardiac events via cardiac autonomic nervous activity[2]. Pranayama and relaxation techniques are the keys to bring the sympathetic and parasympathetic nervous system into harmony[3].Heart rate variability (HRV) has been established as a non-invasive tool to measure continuous interplay between sympathetic and parasympathetic influences on heart rate and yields information about autonomic flexibility[4]. HRV is commonly described by standard deviation of intervals between successive R waves (SDNN- Standard deviation of interval between successive NN intervals) of cardiac cycle[5].Reduced HRV has been established as a predictor for increased risk of cardiac mortality and sudden cardiac arrest[6, 7]especially in patients after myocardial infarction. Frequency measures based on mathematical manipulations performed on the same ECG-derived data. Frequency measures involve the spectral analysis of HRV. Figure 1: shows Spectral analysis of the tachogram which transforms the signal from time to frequency on the x-axis, by representing the signal as a combination of sine and cosine waves, with different amplitudes and frequencies.Analysis of Short-term Recordings (5 min) values for interpretation[5].

Figure 1



- ***Very low frequency (VLF) ranges 0.04 Hz -Sympathetic activity.***
- ***Low frequency (LF) range 0.04–0.15 Hz-Parasympathetic activity***
- ***High frequency (HF) range 0.15-0.4 Hz –***

Stretching exercise and Pranayama is a form of exercise and relaxation which has been proven to improve heart rate variability in the healthy population.

MATERIALS & METHODS

The study was conducted on fifty young adults with an age group of 26–50 (45.1±13.13) with 25 women and 25 men, who were newly

recruited for yoga training at Yoga Center, Salem. Informed consent was taken from all the subjects who volunteered for the study. Institutional ethical clearance was obtained. They were motivated to undergo stretching exercises and Pranayama training for 90 min (in the morning 5.30 am to 7 am) daily for 6 days a week. All of them were asked to have balanced vegetarian diet.

Interventions

The program started with about 15 min resting poses, continued by 30 min standing poses, backbends and inverted poses and ended with another 15 min of resting poses. The sequence of asanas is shown in Fig .3.

a) Shavasana/corpseposition
b)Purvottanasana on bench and support/intense stretch of the front of the body
c) Ardha Chandrasana with a trestle/half-moon standing position
d)Urdhva Dhanurasana with support/upward bow pose
e)Bhismacharyasana with support/backbend

FIGURE NO.3

DIFFIRENT POSTURE OF STREACHING EXERCECISES AND PRANAYAMA

Trainingprogram ends with the Bhismacharyasana, followed by breathing exercises:pranava, Nadishuddi and Savitri pranayama. The subjects sat in Padmasana. The left arm was straight and was placed on left knee. All the three types of Pranayama i.e., Pranava, Nadi shuddi and Savithri Pranayama were done one after the other. Each one was

done for 10 rounds.After one year of regular practice of stretching exercises and Pranayama, HRV was recorded for 5 min in supine position in a quiet room by using (Fig no.2 CARDIART 8408 VIEW) HRV machine. Results thus obtained were tabulated and statistically analyzed using paired students' test and Pearson's correlation test. To avoid irregularity of yoga practice bias, attendance was takento avoid misinterpretations of our findings due to interindividual and circadian variability the group of yoga practitioners was also compared to an age and gender matched group of healthy individuals without evidence of cardiovascular disease who have not been practicing any relaxation techniques previously to identify long-term effects. All the tests were carried out at the same time of the day, between 7am to 8am to avoid diurnal variations.[7]

Figure 2

Inclusion criteria

Regular yoga practitioners aged between 26-50 years.

Exclusion criteria

>50years aged people Medical and psychiatric conditions,Anxiety disorder Asthma, Cardiovascular conditions, Chronic obstructive pulmonary disorder and chronic pain

RESULTS

Before yoga SDNN mean (0.0326±0.0071). At the end of one year regular yoga practice mean SDNN was(0.089±0.039). (Fig .4)

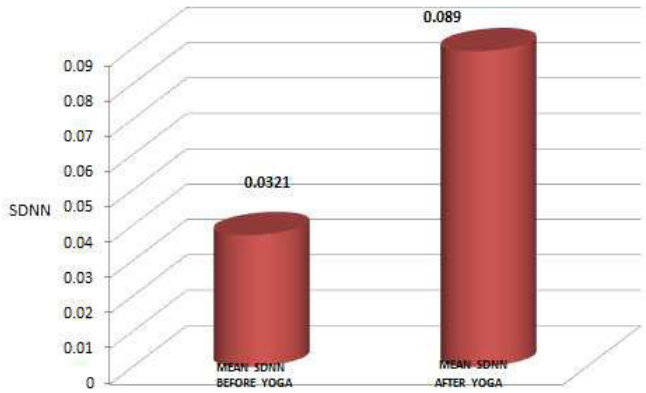


Figure no.4
COMPARISION OF MEAN SDNN BEFORE AND AFTER YOGA

There was *positive correlation* between HRV and duration of yoga practice(r=+0.946, p<0.001) (Fig.5).There was weak correlation with age and no correlation with gender in regular yoga practitioners (r=+0.286).

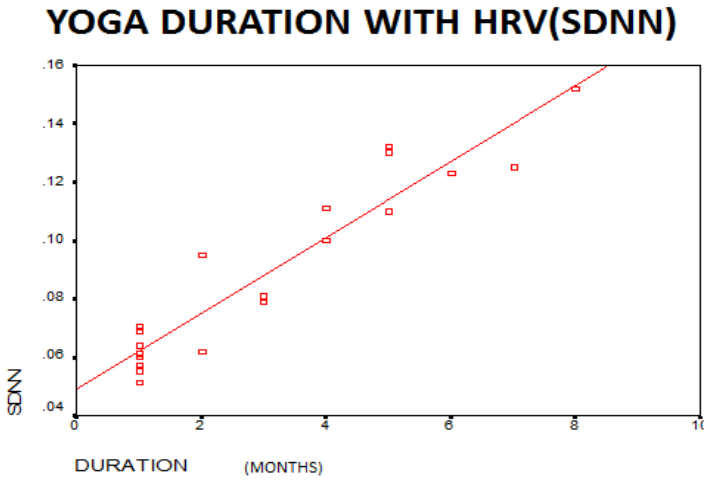


FIGURE NO.5
CORRELATION BETWEEN HRV (SDNN) AND DURATION YOGA

DISCUSSION

Pranayama is a type of yogic breathing exercise and muscular stretching, relaxation techniques is a form of physiological stimulation. Regular practice of Pranayama and muscular stretching and relaxation techniques is a form of adaptation to the repeated stimulus. Breathing is the important autonomic function that can be consciously controlled, through which we influence the involuntary nervous system, i.e. establishing the rhythms of breathing which influences the involuntary nervous system and is the key to bring the sympathetic and parasympathetic nervous system into harmony[3].A study by Ravindra et al.On patient

with premature ventricular complexes (PVC) and episodes of palpitations found that pranayama produced an immediate relief of palpitations and PVC. This improvement could be because of reduction of sympathetic reactivity attained by pranayama training[9].Van Dixhoorn and White of 27 controlled trials in which patients with myocardial infarction trained relaxation techniques such as progressive muscle relaxation, autogenic training, biofeedback, breath relaxation, hypnosis and psychological training. These studies investigated and revealed a positive effect on HRV[10]. La Rovere *et al.*[11] showed that exercise training by bicycle ergometry, an established training method in cardiac rehabilitation programs, increases vagal activity in patients after myocardial infarction, showed baroreflex sensitivity as an autonomic marker.It shows combination of exercise with an increase in baroreflex sensitivity that predicted a better survival.Kukielka *et al.*[12]reported that submaximal long-duration exercise suggests higher cardiac vagal activity during exercise in the trained state.In our study,before yoga SDNN mean (0.0326±0.0071). At the end of one year regular yoga practice mean SDNN was (0.089±0.039) (Fig .4).There was a *positive correlation* between HRV and duration of yoga practice($r=+0.946$, $p<0.001$). We could show that training of different combination of relaxation techniques among healthy yoga practitioners was showed to shift the autonomic balance towards an increase of vagal activity.

This method might be superior to other relaxation techniques since it is a unique combination of relaxation achieved by muscle stretching and relaxing, deep breathing, awareness of breath (Biofeedback)[2], psychological aspects like concentration and meditation. The asanas can be tailored for any condition. Back bending actions give a lengthwise stretch to the mediastinum.More inverted postures which increase venous return to the heart.Every asana and pranayama technique improves respiration and achieves a higher oxygenation of blood. The postures are chosen and modified in a way to improve the loading–unloading conditions of the heart and build up body tension like standing poses or backbends, using slow and more isometric muscle contraction, the heart rate did not raise much. A slow heartbeat prolongs the diastolic filling of the heart and increases myocardial perfusion[11, 14]. The applied techniques of relaxation were progressive muscle relaxation, breath relaxation, deep breathing, cue controlled relaxation and biofeedback causes remodeling of heart[13] which could positively influence HRV.The crucial role of cardiac vagal modulation regarding cardiovascular mortality in post-infarction patients undergoing modern treatment, particularly treatment involving acute revascularization procedures[14].This study demonstrates that relaxation by yoga training is associated with a significant increase of cardiac vagal modulation among yoga practitioners. Since this method is easy to apply with no side effects, and leads to a deep physical and mental relaxation[15, 16], it could be a suitable intervention during cardiac rehabilitation to shift the autonomic balance towards an increase of vagal activity and possibly decrease cardiac mortality.

CONCLUSION

1. There was a statistically significant increase in HRV in regular yoga practitioners indicating parasympathetic dominance.
2. These asanasis suitable intervention during cardiac rehabilitation to shift the autonomic balance towards an increase of vagal activity and possibly decrease cardiac mortality.
3. The demonstrated positive effect of therapeutic breathing and relaxation techniques on the cardiac vagal modulation can be advised to cardiac patients and introduced into cardiac rehabilitation programs in post myocardial patients undergoing modern treatments like acute revascularization procedures and patients with cardiac arrhythmias.

REFERENCES

1. Kjellgren A, et al., Wellness through a comprehensive yogic breathing program - a controlled pilot trial.BMC Complement Altern Med. 2007 Dec 19;7:43
2. Del Pozo JM, Gervirtz RN, Scher B, Guarneri E. Biofeedback treatment increases heart rate variability in patients with known coronary artery disease. Am Heart J. 2004; E11:G1–8.
3. Grover P, Varma VD, Pershad D, Verma SK. Role of yoga in the treatment of psychoneuron's Bull. P.G.I. 1998; 22(2): 68-76.
4. Ewing DJ, Neilson JMM, Travis P. New method for assessing parasympathetic activity using 24 hour electrocardiograpms. Br Heart J. 1984;52:396–402 .
5. Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology. Heart rate variability: standards of measurement, physiological interpretation, and clinical use. Circulation.1996; 93:1043–65.
6. Bigger JT, Jr, Kleiger RE, Fleiss JL, Rolnitzky LM, Steinmann RC, Miller JP. and the Multicenter Post-Infarction Research Group. Components of heart rate variability measured during healing of acute myocardial infarction. Am J Cardiol.1988; 61:208–15.
7. Malik M, Farrell T, Cripps T, Camm AJ. Heart rate variability in relation to prognosis after myocardial infarction.Selection of optimal processing techniques.Eur Heart J. 1989;10:1060–74.
8. Bonnemeier H, Wiegand UKH, Brandes A, Kluge N, Katus HA, Richardt G, et al. Circarian profile of cardiac autonomic nervous modulation in healthy subjects: differing effects of aging and gender on heart rate variability. J CardiovascElectrophysiol. 2003;14:1–9.
9. Ravindra et al. International J cardiology.2006; 108:124-125.
10. VanDixhoorn J, White A. Relaxation therapy for rehabilitation and prevention in ischaemic heart disease: a systematic review and metaanalysis. Eur J CardiovascPrevRehabil. 2005;12:193–202.
11. La Rovere MT, Bersano C, Gnemmi M, Specchia G, Schwartz PJ. Exercise-induced increase in baroreflex sensitivity predicts improved prognosis after myocardial infarction. Circulation.2002; 106:945–9.
12. Kukielka M, Seals DR, Billmann GE. Cardiac vagal modulation of heart rate during prolonged submaximal exercise in animals with healed myocardial infarctions: effects of training. Am J Physiol Heart Circ Physiol. 2005;290:H1680–5.
13. Duru F, Candinas R, Dziekan G, Goebbels U, Myers J, Dubach P. Effect of exercise training on heart rate variability in patients with new-onset left ventricular dysfunction after myocardial infarction. Am Heart J. 2000; 140:157–61.
14. Hase S, Douglas A. Effects of relaxation training on recovery from myocardial infarction.Aust J AdvNurs. 1987; 5:18–27.
15. Sarang, Patil; Telles, Shirley.International Journal of Stress Management. Vol 13(4), Nov 2006, 460-475.
16. Kozasa EH, et al., Evaluation of Siddha Samadhi Yoga for anxiety and depression symptoms: a preliminary study.Psychol Rep. 2008 Aug;103(1):271-4.