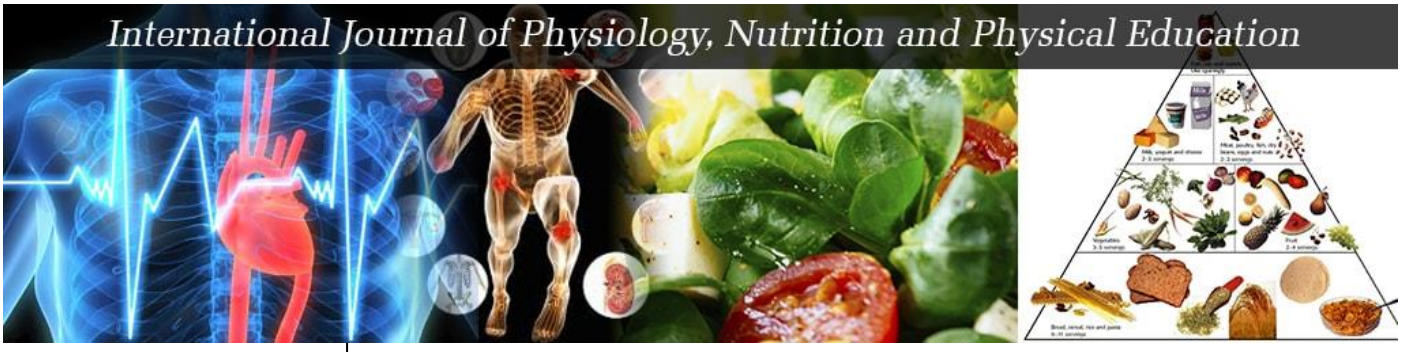

ISSN: 2456-0057
IJPNPE 2018; 3(2): 897-900

www.journalofsports.com
Received: 12-05-2018
Accepted: 13-06-2018

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Effect of short term pranayama on heart rate variability in hypothyroidism

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Abstract
Introduction: Thyroid dysfunctions are common global health problems, hypothyroidism accounting for 5–15% and hyperthyroidism 0.3 to 0.6% in general population. Recently, the incidence of thyroid dysfunctions has increased considerably and presently, the burden of thyroid disorders in India is about 42 millions
Methodology: The present study was conducted on 50 volunteers' in between 18-30yrs of age. After obtaining ethical clearance from the institutional Human Ethics Committee. Inclusion criteria consisting of 18-30 years of aged women, newly diagnosed hypothyroidism. Pregnant or breast-feeding, addicted to alcohol or drugs, those who are already practicing pranayama were the criteria to exclude the patients.
Results: Within group differences of HRV parameters were depicted in Table 2. Following pranayama training, the frequency domain measures of HRV showed significant reduction in LFnu and improvement in HFnu in both the groups. However the increase in HFnu in PG was 165.54% and in CG was 45.26%. The decrease in LFnu in PG and CG was 57.12% and 27.74% respectively.
Conclusion: The results of this study demonstrate that regular practice of pranayama in addition to standard medical therapy is more beneficial to improve heart rate variability in hypothyroid patients.

Keywords: Hypothyroidism, heart rate variability, autonomic function

Introduction
Thyroid dysfunctions are common global health problems, hypothyroidism accounting for 5–15% and hyperthyroidism 0.3 to 0.6% in general population. Recently, the incidence of thyroid dysfunctions has increased considerably and presently, the burden of thyroid disorders in India is about 42 millions [1]. It is not clearly known; whether the increased occurrence of thyroid dysfunctions is directly linked to the change in life style in the society. However, it is well documented that diabetes, hypertension and coronary artery diseases are directly associated with the degree of stress and physical inactivity [2], and the common pathophysiological basis of these disorders has recently been attributed mainly to the autonomic imbalance [3]. Thyroid hormones are the major regulators of metabolism, and the degree of metabolism has a direct impact on sympathovagal balance. Affection of cardiovascular system is one of the most frequent and most serious clinical manifestations of thyroid dysfunctions [4].
Nevertheless, the type and the degree of autonomic imbalance and its contribution to cardiovascular abnormalities in thyroid dysfunctions have not yet been fully investigated.
The utilization of yoga as a therapeutic tool, which started out early in the 20th century, takes benefit of a variety of psycho physiological benefits of the component practices. The asanas may improves the patient's flexibility, co-ordination as well as strength, while the pranayama and also meditation techniques may calm and focus the mind to improve better awareness as well as reduce anxiety [5], thus results in higher QoL. Further useful outcomes may include a reduction of distress, blood pressure, improves mood and also metabolic regulation [6]. Khalsa reported that a majority of the research conducted on therapeutic potential of yoga was performed in India and a considerable portion of these were documented in Indian journals, many of which are usually tough to obtain for Western clinicians and scientists [6].
Since Pranayama have proven to have beneficial and therapeutic effects, in normal and diseased states alike, we plan to study the effects of short term (1 month) practice of pranayama on heart rate variability in hypothyroid patients.

Materials and methods

The present study was conducted on 50 volunteers' in between 18-30yrs of age. After obtaining ethical clearance from the institutional Human Ethics Committee. Inclusion criteria consisting of 18-30 years of aged women, newly diagnosed hypothyroidism. Pregnant or breast-feeding, addicted to alcohol or drugs, those who are already practicing pranayama was the criteria to exclude the patients.

All consenting subjects meeting inclusion and exclusion criteria of the study was selected and informed written consent was obtained after thoroughly explaining the procedure. They were randomly divided into two groups with 25 patients in each group.

Pranayama group (PG) (n=25) patients were diagnosed with hypothyroidism and given one month pranayama training in addition to standard medical treatment. The *Control group (CG) (n=25)* participants were also hypothyroid patients on standard medical treatment only.

All experiments were performed at the cardiac autonomic function research laboratory in Dept of Physiology, Narayana Medical College (NMC), Nellore. The patients were asked to refrain from heavy physical activity for 24 hours and from consumption of alcohol and caffeinated beverages for 12 hours prior to the measurements. The temperature of the laboratory was kept between 25 ºC – 28 ºC and lights subdued. The patients were asked to void urine before testing and made to sit in the lab comfortably to accustom to the new environment. Baseline and anthropometric parameters were recorded before recording of HRV.

Recording of short term heart rate variability

At supine rest with the eyes closed and relaxed position, lead II ECG was acquired at the rate of 2000 samples/second for 10 minutes with the normal breath rate of 12 – 18/min using computerized ECG recording system (Cardiowin system, PC based 12 channel simultaneous digital ECG, Genesis Media System Pvt. Ltd, India). An RR series was extracted from ECG using maximum amplitude and sharpness of the peaks for R wave detection. After exclusion of artifacts and ectopics a stationary 256s RR series was chosen and analyzed with Kubios HRV Version 2.0 software for HRV (Bio-signal analysis Group, Finland).

Intervention

After the pre-test, instructions were given to pranayamaa group about the practices. After the initial instructions they have practiced the following

Loosening procedures	: 5 min
Chandranadi pranayama	: 2 min
Bhramari pranayama	: 2 min
Nadishuddi pranayama	: 2 min
Pranava pranayama	: 2 min
Shavasana	: 15 min

The pranayama group practiced the above schedule for 3 days a week under our direct supervision and remaining days at home. At the end of one month, all the parameters were recorded and the obtained data was analyzed statistically.

Statistical analysis

Statistical analyses were conducted utilizing the R for windows. Descriptive statistics were expressed as means and standard deviations for continuous variables. After examining for normality, 2 tailed paired t - test for normally distributed data of within group difference, independent t test to test the % change in between group difference and Mann - Whitney U- test for skewed data for within group and between group was used. The null hypothesis was rejected at $p<0.05$.

Results

The baseline characteristics of the patients assigned to PG (n=22), CG (n=25) are given in Table 1.

Assessment of HRV

Within group differences of HRV parameters were depicted in Table 2. The frequency domain measures of HRV showed significant reduction in LFnu and improvement in HFnu in both the groups. However the increase in HFnu in PG was 165.54% and in CG was 45.26%. The decrease in LFnu in PG and CG was 57.12% and 27.74% respectively, given in Table 3.

Table 1: Patient's demographics and baseline characteristics.

Sl. no	Parameter	PG (n=22)	CG (n=25)
1	Age (years)	25.48 ± 5.61	28.65 ± 7.45
2	BMI (kg/m^2)	25.56 ± 3.25	26.45 ± 4.25
3	HR (bpm)	71.45 ± 7.81	73.37 ± 8.67
4	SBP (mmHg)	107.56 ± 35.98	112.34 ± 29.94
5	DBP (mmHg)	73.45 ± 25.56	75.56 ± 24.56
6	Free - T3 (pg/ml)	1.50 ± 0.48	1.62 ± 0.59
7	Free - T4 (ng/dl)	0.68 ± 0.18	0.72 ± 0.21
8	TSH (uIU/mL))	96.37 ± 21.34	112.63 ± 42.56

Data presented are mean ± SD; BMI=Body mass index; HR=Heart rate; SBP=systolic blood pressure; DBP=Diastolic blood pressure; TSH=Thyroid stimulating hormone.

Table 2: Within group differences of short term heart rate variability.

Sl. No	Parameter	PG (n=22)		CG (n=25)	
		Time = 0 month	Time = 1 month	Time = 0 month	Time = 1 month
1	Mean RR (s)	937.31 ± 165.97	880.87 ± 132.8	808.7 ± 127.09	799.1 ± 118.12
2	RMSSD (ms)	64.06 ± 22.98	68.18 ± 18.08**	74.48 ± 12.45	75.45 ± 12.08*
3	LF nu	74.4 ±13.08	31.90 ± 12.96***	62.0 ± 13.98	44.80 ± 15.05**
4	HF nu	25.65 ± 12.87	68.11 ± 21.97***	38.0 ± 10.54	55.20 ± 12.98**
5	Total power (ms^2)	1042.8 ± 276.09	130.76 ± 11.98***	891.99 ± 134.96	539.88 ± 111.9**
6	LF/HF	2.90 ± 0.53	0.47 ± 0.11***	1.63 ± 0.89	0.81 ± 0.29*

*$p<0.05$, **$p<0.01$, ***$p<0.001$.

Data presented are mean ± SD; $p<0.05$ were considered statistically significant. RMSSD: Root mean squares of the differences between adjacent NN intervals; LFnu=Normalized low frequency power; HFnu=Normalized high frequency power.

Table 3: Between group differences of short term heart rate variability.

Sl. No	Parameter	Mean % change from baseline	
		PG (n=22)	CG (n=25)
1	Mean RR (s)	6.02 *	1.18
2	RMSSD (ms)	6.43*	1.30
3	LF nu	57.12***	27.74
4	HF nu	165.54***	45.26
5	Total power (ms^2)	87.46**	39.47
6	LF/HF	83.79***	50.3

*p<0.05, **p<0.01, ***p<0.001

Data presented are mean ± SD; p<0.05 were considered statistically significant. RMSSD: Root mean squares of the differences between adjacent NN intervals; LFnu=Normalized low frequency power; HFnu=Normalized high frequency power.

Discussion

Yoga is fast emerging as a new discipline for integrating mind and body into harmony [8]. Asana (postures) and pranayama (breathing exercises) in the form of yoga may be beneficial in the rehabilitation of cardiovascular diseases [9]. Studies have demonstrated the effect of yoga on improvement of lipid profiles [10], blood pressure [11], psychological well-being, and even regression of atherosclerosis when combined with dietary and other lifestyle modifications [6, 7], left ventricle ejection fraction in coronary heart patients [14], improves quality of life, functional capacity [15] cardiac function [16] heart rate, blood pressure, rate pressure product, cardiac autonomic function [17] oxidative stress and inflammation in heart failure [18]. Despite of the widespread appeal of yoga, data on effect pranayama practice on HRV limited.

In our study the increased HFnu in HRV and reduced LFnu in HRV represents reduction in sympathetic activity. Further these improvement is higher is pranayama group when compare to control group.

Mechanisms by which yoga may have improved the parasympathetic dominance in PG in this study are speculative at this time. In addition to the proposed mechanism of yoga's ability to attenuate the derangement of autonomic nervous system, its effect on BP may be a benefit as well, yoga may also promote effective extraction of oxygen by peripheral tissues. When a muscle is stretched, the O_2 consumption increases. Studies that examined the health-related aspects of yoga found that 8 week yoga training increased muscular strength by 31%, increased muscular endurance by 57%, increased flexibility by 88%, increased oxygen uptake by 7% and reduced cardiovascular risk in healthy adults [19]. This reduces the stress of myocardium [16]. Further, Slow pranayama breathing generates inhibitory signals and hyperpolarizing current within neural and non-neural tissue by mechanically stretching tissues during breath inhalation and retention. It is likely that inhibitory impulses in cooperation with hyper polarization current initiates the synchronization of neural elements in the central nervous system, peripheral nervous system, and surrounding tissues ultimately causing shifts in the autonomic balance towards parasympathetic dominance [20].

Conclusion

The results of this study demonstrate that regular practice of pranayama in addition to standard medical therapy is more beneficial to improve heart rate variability in hypothyroid patients.

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