



INFLUENCE OF SINGLE SESSION OF SURYANAMASKARA AND BICYCLE ERGOMETER ON HRV PARAMETERS IN NOVICE PARTICIPANTS

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ABSTRACT

Physical activity is inevitable to keep health in good status. There are studies to show the differences between various types of exercises in health and disease. Post-exercise / physical activity cardiac autonomic control depends on exercise modality which remains unclear. Heart rate variability (HRV) has been used as a non-invasive method to evaluate heart rate (HR) regulation by the parasympathetic and sympathetic divisions of the autonomic nervous system. We compared the Suryanamaskara (SN) and bicycle ergometer exercise and their effect on heart rate variability in sixty novice participants. Age and gender matched sixty subjects were divided into two groups, Group I performed SN & Group II Bicycle ergometer exercise for 30mins. Recording was taken at Basal and immediately after activity. Results showed the significant increase in Heart rate, LF/HF ratio and decrease in High frequency (HF) domain in both groups immediately after the activity. But a trend observed towards sympathetic activity in exercise group compared to SN group

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INTRODUCTION

Heart rate variability (HRV), the changes in time between consecutive R-R interval, has been widely used as a non-invasive assessment tool to estimate changes in cardiac autonomic modulation in different physiological conditions. Largely applied to predict sudden cardiac death and diabetic neuropathies in assessing disease progression (1), recent studies have demonstrated the application of HRV in exercise training. Study findings have supported the use of HRV as a marker to reflect the cardiac modulation of the sympathetic and vagal component of the Autonomic Nervous System (2). Disruption of autonomic balance leads to cardiovascular disease. Physical activities are advised for health promotion and prophylaxis for many cardiovascular diseases and also for rehabilitation after an episode of disease. Even though regular physical exercise improves the autonomic functions, sudden death reported during or immediately after exercise is attributed to acute change in autonomic tone (3), hence exercise is referred as double edge sword. There are studies to show the differences between various types of exercises (4) in health and disease and there are studies focused on effects of exercise and yoga training (5) on HRV, but less is known about immediate effects. A single bout of moderate intensity aerobic exercise for as less as 30 minutes has improved cognitive performance mainly memory,

reasoning and planning (6). A study on obese young adults has shown that a single bout of isotonic exercise has improved ocular perfusion pressure which maintains ocular health.(7). There are limited studies that have focused on the immediate effects of a single yoga session and these include, a single 90-minute hatha yoga class that showed significant reduction in perceived stress (8). Study on cognitive performance after a yoga session was significantly superior as compared with an aerobic session (9). A recent report on the acute effects of one session of hatha yoga practice on blood pressure and other cardiovascular responses in healthy volunteers has showed that systolic, mean, and diastolic blood pressures increased significantly during the yoga practice.

There were statistically significant ($p < 0.001$) reductions in all the studied cardiovascular parameters (HR, SBP and DBP) following the yoga session. The magnitude of reductions differed in the groups, it being more significant in those having hypertension and less significant in those having endocrine/skin and musculoskeletal conditions. It was moderately significant in the normal subjects as well as patients having psychiatric and respiratory conditions. (10)

Objectives: To assess the modulation of autonomic functions following Single bout of exercise & yoga in healthy individuals.

METHODS

It was interventional study in which 60 healthy subjects aged 18-25 years of both gender were selected after obtaining

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informed consent. Subjects were neither sportspersons nor yoga practitioners and were not taking any medications were divided into two groups for physical activities. Subjects were asked to abstain from use of caffeine and other stimulants 12 hours before study and strenuous exercise 24 hours before the study. They were asked to have their breakfast 2 h prior to the activity. The subjects were accustomed with the activity and instruments used for recording and were briefed about the procedure. Basal HRV recordings were done after 10 min of supine rest. In female subjects, recording was done during the proliferative phase of the menstrual cycle. Between 10am to 12 noon each subjects performed prescribed activities. Subjects in group 1 were asked to perform surya namskara for 30mins, atleast 12 cycles in 30mins. Subjects in group 2 were asked to pedal bicycle ergo meter (INCO company) for 30mins at speed of 60-80 rpm.(11)

HRV was recorded in both groups using standard procedure, for 10 mins in sound attenuated room by Powerlab AD instrument (power lab^R 8/30, ML 870 high performance data acquisition system with lab chart^R 7.1 pro version 7.3.7 software for windows). For recording subjects were instrumented with ECG leads. Basal and immediately after 30 minutes of activity in both groups the HRV was recorded. Spectral analysis of HRV was based on the fast Fourier transformation (FFT). The time (HR, RMSSD) and spectral (LF, HF) parameters were analysed.

RESULTS

Analysis was done using SPSS 24 paired sample test and Independent sample test. At basal level there was no differences in values measured, the significant increase in Heart rate, LF/HF ratio and decrease in High frequency (HF) domain in both groups was observed immediately after the activity. There was reduction in values of LF/HF ratio and increase in HF in SN performers compared to exercise group which was not significant.

Table 1 HRV parameters before and after Bicycle ergo meter exercise

	Basal	Immediately after	p value
Avg HR	95.35± 21	114.69± 31.67	0.046*
SDNN	144.12±98	162.79±82	0.499
RMSSD	142.15±142	150.98±140	0.765
NN50	84.16±112	86.44±136	0.961
VLF	5671.22±14241	4681.433±12270	0.775
LF	38.61±21	32.05±20	0.318
HF	35.09±15	24.78±11	0.027*
LF/HF	1.37±1	1.8±1	0.039*

*P<0.05

Table 2 HRV parameters before and after Suryanamaskara

	Basal	Immediately after	p value
Avg HR	92.89±17	112.05±41	0.047*
SDNN	110.86±87	171.52±116	0.014*
RMSSD	127.45±108	191.45±144	0.058*
NN50	65.83 ± 58	189.16 ±324	0.122
VLF	765.17±762	2177.93 ±3974	0.172
LF	37.32±16	37.40±21	0.992
HF	34.33±21	25.83 ±9	0.049*
LF/HF	1.23±0.8	1.76±1.5	0.045*

*P<0.05

Table 3 Comparison HRV parameters after Bicycle ergometer exercise and SN

	Exercise im after	SN Immediately after	p value
Avg HR	114.69± 31.67	112.05±41	0.653
SDNN	162.79±82	171.52±116	0.063
RMSSD	150.98±140	191.45±144	0.378
NN50	86.44±136	189.16 ±324	0.131
VLF	4681.433±12270	2177.93 ±3974	0.226
LF	32.05±20	37.40±21	0.868
HF	24.78±11	25.83 ±9	0.812
LF/HF	1.8±1	1.76±1.5	0.345

DISCUSSION

The goal of single session exercise is to transiently disturb body homeostasis after which a so called super compensation, an improvement in performance, can occur if recovery period is adequate.

Our study showed increased HR following single session activities which is supported by previous studies (12, 13,14) indicating vagal withdrawal and an enhanced sympathetic drive, While the study by Ananda Balayogi Bhavani showed decreased HR following single session yoga. (10)

The mean value of VLF showed no significant increase after both the activities, but other studies have shown significant increase in VLF after mere exercise (Jovanov 2007). Though it is difficult to comment VLF in short term recording, the increased VLF reflects the physiological axes of thermoregulatory and local renin-angiotensin system.

An attenuated HF and increased LF after both bicycle ergo meter exercise and SN represents the normal physiological response of vagal withdrawal and stimulated sympathetic drive.

Comparison of bicycle ergo meter exercise and SN showed no significant reduction in HR, VLF, LF/HF and increased HF in SN group indicating a trend towards parasympathetic activity in SN and sympathetic activity in bicycle ergo meter.

Acute change in autonomic tone in the form of HRV parameter values suggesting upper hand of sympathetic activity after bicycle ergo meter indicates the high risk individuals (hypertensives, cardiac patients) are more prone to subsequent complications of sympathetic drive.

Exercise is associated with increased sympathetic tone and parasympathetic withdrawal leading to decreased HRV, which has been related to an increased risk of cardiac disease and mortality. (3)

HRV is significantly decreased during exercise as sympathetic activity is augmented and vagal activity is attenuated. Immediately after exercise cessation, changes occur in baroreceptors function, central command and cardiac pre-load and contractility, which affect cardiac functions together with increased vagal activity (15).

But the recovery dynamics of HRV depends on intensity of exercise. It is observed that there is Slower recovery of HRV for moderate & high intensity and faster for low intensity exercise (16). Explanation for slower recovery or slower vagal reactivation after exercise at moderate / high intensity may be the higher proportion of sympathetic modulation and accumulation of anaerobic metabolites during exercise. In present study though the recovery is not tested, variation in HRV may be attributed the intensity of activity involved.

CONCLUSION

Our study shows increased sympathetic activity in both groups immediately after the activity. Even though the comparison between participants of exercise on bicycle ergo meter group and SN group shows no significant difference in HRV parameters, there was a trend observed towards sympathetic activity in exercise group compared to SN group. Hence it is important to know the intensity of physical activity while prescribing it to high risk individuals.

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