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Effect of Aerobic Exercise and Yoga on Heart Rate Variability (HRV) Parameters in Young Adults

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ABSTRACT

Analysis of beat-to-beat variability of heart rate(HR) has been stated to represent one of the promising quantitative markers of autonomic activity. Dysregulation of autonomic activity seen in life style associated disease is believed to be modified by physical activity. Present study was to evaluate and compare the autonomic activity in aerobic exercisers and yoga practitioners. Ninety healthy male subjects aged 30-40 years were included in the study. The study consisted of three group with 30 subjects in each. Group1: Subjects who practiced regular structured aerobic exercise for a period of minimum 6 months. Group 2: Subjects practiced yoga regularly for a period of minimum 6 months. Group 3: Healthy subjects (normal BMI) neither practiced yoga or any type of exercise regularly. Heart Rate and HRV were recorded in all subjects using standard procedures. The study showed decreased LF (Low Frequency) in Yoga group and exercise group than control group, also decreased HR, and LF/HF(Low frequency / High Frequency) ratio and increase HR in yoga group. This indicates that parasympathetic activity is substantially greater in yoga practitioners followed by athletes and control.

Keywords : *Aerobic exercise, yoga, HRV.*

INTRODUCTION

Lifestyle diseases are increasing, especially in developing countries at high rate. Advancement in the technology has led to physical inactivity, which has been majorly blamed for the rise in life style associated disorders which is indicated by disruption of autonomic balance and prolonged autonomic imbalance is associated with a wide range of somatic and mental diseases. The cardiovascular system is mostly controlled by autonomic regulation through the activity of sympathetic and parasympathetic pathways of the autonomic nervous system. Analysis of HRV permits insight in autonomic control mechanism[1]. Heart rate variability (HRV) has been used as a proxy for health and fitness and indicator of autonomic regulation. The three components found in HRV power spectrum: (a) a peak at respiratory frequency that corresponds to respiratory sinus arrhythmia (HF, > 0.15 Hz) ; (b) a peak centered at about 0.1 Hz that is related to arterial pressure control (LF 0.04-0.15 Hz); (c) a component at very low frequency (VLF, <0.04 Hz) considered to be expression of the peripheral vasomotor regulation[2]. Physical exercise in general is reported to reduce the occurrence of cardiovascular diseases and possible complications arising out of them. Hence Physical activity is proved to be highly beneficial concerned with life style disorders. Exercise is considered as an acceptable method for improving & maintaining physical and emotional health. Although yoga is historically a spiritual discipline, a growing body of evidence supports the belief that yoga benefits physical & mental health. Hence, we propose to compare the effect of two types of physical activity i.e. aerobic exercise and yoga on HRV in young healthy subjects.

MATERIALS & METHOD

Ninety healthy male volunteers aged 30-40 yrs were selected for our cross sectional study. The mean height of subjects was 170±4cm (range 164-178 cm) and weight 68±6 kg (range 57-79 kg). The study included 3 groups having 30 subjects in each group. Group1(A): Subjects who practiced regular structured aerobic exercise for a period of minimum 6 months in sports schools of the city. Group 2(Y): Subjects practiced yoga regularly

for a period of minimum 6 months in various yoga schools. Group 3(C): Healthy subjects (normal BMI) neither practiced yoga or any type of exercise regularly. Subjects with history of hypertension, diabetes mellitus, any chronic illness were excluded from the study. The subjects were ascertained to be healthy after a thorough clinical examination. They were briefed about the study & informed consent was obtained. Institutional ethical committee approval was obtained.

Heart Rate and HRV were recorded in all subjects using standard procedures. Recordings were done for 5 to 6mins. as both 24-hour and brief, resting HRV have been linked to cardiovascular outcomes and a brief, resting HRV measurement of four to five minutes is sufficient[3] for the measures used in our study in sound attenuated room by Niviqure ambulatory system which is a computerized ECG recording system, that allows to acquire, analyze and store ECG data over long hours (Niviqure Meditech Systems, Bangalore, India) [4] On each subject ECG was recorded using disposable Ag/AgCl solid adhesive pre-gelled electrodes in standard lead II configuration. The ECG was acquired using an ambulatory ECG system (Niviqure) at the sampling rate of 1024 Hz and was stored on the hard disc of a PC (Pentium IV) for analysis. The R waves were detected to obtain a point event series of successive R-R intervals, from which the beat to beat heart series were computed. The data recorded was visually inspected off-line and noise free data were included for the analysis.

The variables were measured were, LF (Low frequency power of HRV spectrum), HF (High frequency power of HRV spectrum), LF/HF Ratio of low and high frequency powers, HR (b/min) .

HF reflects efferent vagal activity. LF is considered by some researchers to reflect both sympathetic and parasympathetic modulation while others consider it a measure of vagal withdrawal. The LF/HF ratio was calculated to assess the sympatho - vagal balance [5].

RESULTS

ANOVA analysis was done using SPSS version 19. The analysis of data was done by One way ANOVA and multiple comparision by Dunnett T3 test. HR and HRV on frequency domain includes HF (High frequency) component (0.15-0.4 Hz) and LF(Low frequency) component (0.04-0.15Hz). The study showed increased LF in control group followed by athletes and Yoga group, also decreased HR, HF and LF/HF ratio in yoga group.

Table No 1: Frequency domain parameters of HRV of all three groups (Mean ± SD)

Parameters	Group 1 (A)	Group 2 (Y)	Group 3 (C)	p value
HR(beats/min)	69.08± 8.89$	68.01±7.08*	72.53± 10.33	0.003
LF ms^2	512.35± 782.07$	369.05± 287.43* #	632.30± 624.18	0.001
HF ms^2	986.11± 1001.53$	1439.79± 1196.44* #	804.91±1009.84	0.001
LH/HF	1.88±1.50$	1.36± 0.97* #	2.20±1.94	0.001

note: significant p value <0.05 . significant Dunnett T3 P values shown as

*$p_1 \leq 0.05$ yoga vs sedentary, #$p_2 \leq 0.05$ yoga vs aerobic exercise $$p_3 \leq 0.05$ aerobic exercise vs sedentary.

DISCUSSION

In the present study, the effect of long-term physical activity in terms of yoga and aerobic exercise was evaluated on cardiac autonomic function. Previous studies have shown no significant changes[5], significant decrease[6] as well as nonsignificant decrease[7] in HR after yoga practice . In our study HR in both group 1 & group 2 was significantly decreased compared to group 3 (control). Autonomic nervous system is known to have an effect by regulating HR[8], which is one of the mechanism that accounts for risk reduction & cardioprotective effect of Physical activity. Yoga shows more decrease in HR compared to aerobic exercise, reason can be attributed to different postures involved in yoga. Supine and inverted body postures stimulate the baroreceptor reflex (from altered negative pressure in the upper body) and may

create a parasympathetic (vagal) activity ,while upright postures inhibit it [9].

A significant decrease in LF was observed in Yoga & exercise group compared to control and significant decrease in yoga group compared with exercise. This may be attributed to inhibition of posterior or sympathetic area of the hypothalamus which optimizes the body's sympathetic responses to stressful stimuli. This helps restore autonomic regulatory reflex mechanisms associated with stress [10] .

A significant increase in HF was observed in Yoga & exercise group compared to control and significant increase in yoga group compared with exercise group, similar to the finding in study by Peter done in different age group individual.

A significant decreased LF/HF ratio (low frequency/ high frequency) in yoga & exercise group compared with control, and yoga group showed further decrease in ration compared with exercise group, indicating a switch towards vagal dominance. In other studies the LF/HF ratio decreased but this change was not significant [11]. An increased LF/HF ratio is often seen in older age[12] but has also been related to depression and stress[13].

The overall beneficial effect of yoga which is shown to be superior to exercise can be explained by, (a) respiratory modulation involved in yoga. Respiratory frequency & depth which influences autonomic control mechanism. (b) yoga involving pranayama as one of important component helps in reducing chemoreflex sensitivity.(c) Slow controlled breathing in yoga functionally resets the autonomic nervous system through stretch induced inhibitory signals and hyperpolarization currents propagated through both neural and non-neural tissue which synchronizes neural elements in the heart, lungs, limbic system and cortex. Both inhibitory impulses and hyperpolarization current are known to synchronize neural elements leading to the modulation of the nervous system and decreased metabolic activity indicative of the parasympathetic state[14]. (d) increase in HRV in Yoga involving stretch of all muscles can be attributed to reason That after stretching there will be release of vasodilative agents (EDRF = Endothelium-derived relaxing factor) which reduces muscle tone, but could also result from a general systemic psychic-physical relaxation [13].

CONCLUSION

Our study results of yoga shows reduction in LF component, significant decrease in HR & increase in HF component compared to aerobic exercise which coincides with the findings of other studies. This supports that yoga influences autonomic nervous system by increasing parasympathetic activity. Our study indicates that parasympathetic activity is substantially greater in yoga practitioners followed by athletes and control. Yoga proves to be as effective as or better than exercise at improving cardiac health and maintenance of autonomic balance. Hence yoga can be implemented in preventing life style associated disorders.

Conflict of Interest : Nil

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