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Research Article

EFFECT OF AGE AND PHYSICAL ACTIVITY ON BAROREFLEX SENSITIVITY IN HEALTHY SUBJECTS

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ABSTRACT
This study was conducted to examine the effect of age and physical activity on baroreflex sensitivity in subjects practicing yoga, athlete and individuals with sedentary lifestyle. Non invasive technique Valsalva maneuver was used to study baroreflex sensitivity in 400 sedentary subjects (not doing any type of physical exercise), 400 athlete subjects and 400 subjects who had been practicing yoga of different age groups. In present study significant reduction in valsalva ratio with increasing age is observed but less reduction in athletes and yoga practitioners. In all age groups valsalva ratio was found increased in yoga practitioners as compared to athlete and sedentary subjects. It is concluded that Yoga slows the aging changes in cardiovascular system and this simple and easy technique can be advocated for reducing the morbidity and mortality from cardiovascular diseases.

Keywords: *Baroreflex, Athlete, Sedentary, Yoga, Valsalva Maneuver*

INTRODUCTION
The interest in baroreflex sensitivity (BRS), an indicator of cardiac autonomic regulation, has grown during the last decade. BRS is decreased in different cardiovascular diseases, including hypertension, coronary artery disease, and congestive heart failure. In addition to cardiovascular diseases, physiological factors such as aging and gender influence BRS. Exercise capacity has also been found to have an impact on BRS, and there is evidence suggesting interaction between hormonal status and BRS. Thus the aim of the present study was to investigate the relationships among BRS, age, and physical activity in a large population of healthy subjects (Esko, 1998).
Yoga is a science practiced in India over thousands of years. It produces consistent physiological changes and have sound scientific basis. All over the world scientists have extensively studied Yoga and claimed that it increases longevity, it has therapeutic and rehabilitative effects. Aging is inevitable and no system is spared of its changes. Still cardiovascular system holds a key position in interpretation of age changes throughout the body. As the age advances cardiovascular regulatory mechanisms (baroreceptor reflex activity) reduces their efficiency (Jyotsana, 2003) In present study the noninvasive technique 'Valsalva maneuver', that challenges the reflex control of the circulation is used to assess the BRS. The present study however was undertaken to ascertain whether Yoga in long term has any effect on slowing the aging changes in cardiovascular system, considering the possibility of advocating this simple and easy technique for reducing the morbidity and mortality from cardiovascular diseases.

MATERIALS AND METHODS
The present study was conducted in the Department of Physiology, Pt. B.D. Sharma, P.G.I.M.S., Rohtak and Department of Physiology, M.A.M.C., Agroha, Hisar.
Study Design: cross-sectional study
***Sample Size*:** The study group was comprised of 1200 healthy male volunteers in the age group of 16 to 55 years. This group was divided into four sub groups, which were 16 to 25 years, 26 to 35 years, 36 to 45 years and 46 to 55 years. All age groups were further divided into three categories, athletes, those practicing yoga and sedentary subjects. Defence personals of Indian army were selected as athlete, yoga practitioners of Patanjali sewa samiti, Hisar were selected as yogi and MBBS students and staff of MAMC, Agroha were selected as sedentary subjects.

Sedentary Life Style: Includes individuals with either no leisure-time physical activity or with activities less than 20 minutes 3 times per week. This definition is as per the Center for Disease Control and Prevention (Prakash, 2007).

Athletes: Includes marathon runners who have been running at least 2 km daily since last 6 months (Prakash, 2007).

Those Practicing Yoga: Subjects practicing pranayam and asanas (posture) for at least one hour daily since last 6 months (Prakash, 2007).

The yogic curriculum included prayers followed by chanting 'om', pranayama and different asanas i.e. different physical postures.

Table1: Yogic Curriculum

Om Chanting, Mantrocharan	
sukshmvyayam	2.5 min
Bhastrika	5 min
Kapalbhati	15 min
Bahypranayam	1.5min
Ujjayi	5 min
Anulomvilom	15 min
Bhramri	1.5 min
Udhgeeth pranayam	1.5 min
PranavDhyan	1 min
Asanas-Vakrasan,Gomukhasan,Mandukasan,Paschimotanasan, Markatasan,Makrasan,Bhujangasan,Shlabhasan,Trikonasan	10 min
Suryanamaskar	2.5 min

Exclusion Criteria: Subjects suffering from any acute or chronic disease, chronic smoker, chronic alcoholics and subjects taking vitamin or nutritional supplement was excluded.

Methodology:All subjects were explained about the procedure to be undertaken and informed written consent (as per attached Performa) was obtained. These subjects were given a questionnaire and personal data form, which they were required to fill up with certain details like their dietary habits, extent of physical activity and family history. All experiments were conducted in between 4 p.m. to 7 p.m. due to (as per) availability of subjects. They were asked to avoid food, tea, coffee, nicotine at least two hour prior to testing. The whole procedure was explained in detail to each subject in order to alley any fear or apprehension. The basic parameters like age, weight and height were measured and recorded in specific proforma attached.

Valsalva's Maneuver: This test was employed for testing baroreceptor reflexes. The subject was asked to blow for fifteen seconds into a mouthpiece which is attached to sphygmomanometer at a pressure of 40 mm Hg. E.C.G. was recorded during the maneuver and for fifteen seconds after release of pressure. The valsalva ratio was calculated as the ratio of longest R-R interval after the maneuver to the shortest R-R interval during the maneuver. Each subject performed two tests, separated by a rest period of five minutes, and the mean of the two ratios was accepted. (Levin AB, 1966)

$$\textbf{Valsalva ratio} = \frac{\textbf{Longest R-R interval after maneuver}}{\textbf{Shortest R-R interval during maneuver}}$$

Statistical Analysis: Data was analysed by using SPSS version-16. Mean and standard deviation were calculated for each parameter. Comparison of mean values by using ANOVA followed by Post-hoc test (Dunnett T3 test) was done for comparison among and between sedentary, athlete and yoga group in each age group. Two way ANOVA was done for each parameter to see the effect of age in all three life styles.

RESULTS AND DISCUSSION

Anthropometric data is depicted in Table 2. All parameters were comparable in sedentary, athlete and yoga subjects of each age group.

Table 2: Anthropometric parameters of sedentary, athlete and yoga subjects of Group A,B,C,D (Mean± SD)

Age	AGE (Years)			HEIGHT (cm)			WEIGHT (Kg)			BMI (kg/m^2)		
Group	S	A	Y	S	A	Y	S	A	Y	S	A	Y
Group A	21.51± 2.18	21.84± 2.05	21.41± 2.10	170.45± 6.80	169.40±4 .71	172.32± 6.75	62.83± 9.47	59.34± 4.71	60.74± 6.98	21.60± 2.95	20.67± 1.44	20.45±2 .00
Group B	30.26± 2.90	30.30± 2.61	29.86± 2.98	170.07± 8.06	171.16±4 .46	169.11±8 .44	66.96± 11.2	67.12± 4.99	63.90± 12.2	23.09± 3.16	22.89± 1.57	22.26±3 .67
Group C	41.26± 3.07	42.88± 2.24	41.12± 2.38	171.57± 5.63	170.99±3 .87	169.33±5 .03	66.80± 7.23	70.09± 4.97	66.58± 7.04	22.70± 2.39	23.98± 1.62	23.20±2 .04
Group D	52.34± 2.70	51.43± 3.05	52.23± 2.75	169.45± 6.31	171.85±6 .10	170.18±5 .25	69.35± 13.9	66.86± 11.0	70.43± 10.6	24.13± 4.61	22.68± 3.87	24.29±3 .30

S-Sedentary; A- Athlete; Y- Yoga

In present study valsalva ratio in age Group A (16-25 years) was significantly high in yoga group as compared to athlete and sedentary group. Athlete group showed statistically increased in ratio as compared to sedentary group. In age Group B (26-35 years) valsalva ratio was not significantly different in between groups. Yoga group had shown insignificant increase in ratio as compared to athlete and sedentary group. In age group C (36-45 years) valsalva ratio was found significantly increased in yoga group as compared to sedentary group and insignificantly in relation to athlete group. In age group D (46-55 years) valsalva ratios were found not significant when compared between groups. Increase in ratio was observed in yoga group as compared to athlete and sedentary group but not significant.

Table 3: Comparison of valsalva ratio in different lifestyle following age (Mean± SD)

Age Group	Sedentary n = 400	Athlete n = 400	Yoga n = 400	Age		Age*Lifestyle	
				F value	p value	F value	p value
Group A	1.56±0.35	1.60±.25	1.72±0.35	30.141	0.001*	0.68	NS
Group B	1.64±.48	1.66±.19	1.70±.27				
Group C	1.58±.36	1.63±.30	1.70±.29				
Group D	1.42±.26	1.45±.22	1.48±.22				

*Two way ANOVA;*p-value ≤.05 is considered significant*

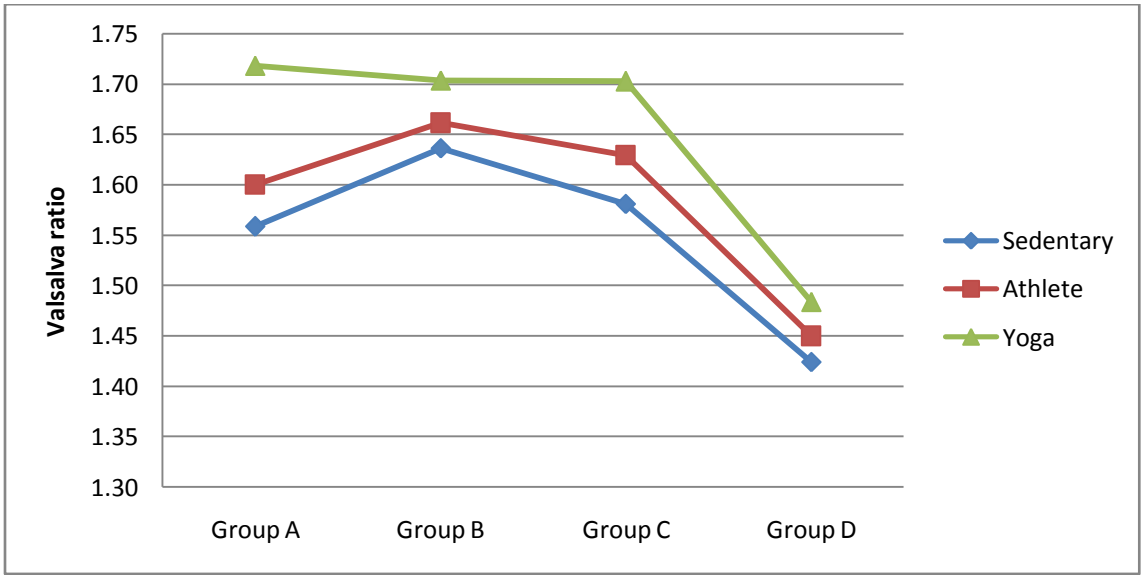

Figure 1: Comparison of valsalva ratio in different age groups of sedentary, athlete and yoga

DISCUSSION

The valsalva ratio was found decreased significantly ($p< 0.05$) from Group A to Group D and decrease was from 1.56±0.35 to 1.42±.26 in sedentary, from 1.60±.25 to 1.45±.22 in athlete and from 1.72±0.35 to 1.48±.22 in yoga but decline was not statistically significant among lifestyle groups. The mean values of valsalva ratio were found higher in yoga and athlete in all age groups as compared to sedentary.

In present study valsalva ratio was found increased in yoga group as compared to athlete and sedentary. Our finding is in accordance with a study by Udupa where nadi-shodhana pranayama and savitri pranayama were included along with Mukh Bhastrika training for three months (Udupa, 2003). Studies on fast pranayama when practiced along with other pranayamas have shown improved cardiovascular autonomic reactivity, as found with Mukh Bhastrika alone. A study on pranayama (which included nadishuddi, pranav and savitri pranayama along with Mukh Bhastrika) training for three months showed enhanced parasympathetic and reduced sympathetic activity. Deepak reported higher values of valsalva ratio signify better parasympathetic activity. Shashikala revealed in their study increase in the parasympathetic and decrease in sympathetic activity with twelve weeks of Mukh Bhastrika training. (Deepak, 2012; Shashikala, 2011)

Kullok suggested the explanation for the changes in autonomic activity by breathing exercises is that there are known anatomical asymmetries in the respiratory, cardiovascular and nervous system and that the coupling mechanisms between each of these systems: - lung-heart, heart-brain and lungs-brain-are also asymmetrical. These asymmetrical vector forces resulting from the mechanical activity of the lungs, heart and blood moving throughout the circulatory system, produce a lateralization effect in the autonomic balance. They postulated the existence of negative feedback loops between brain autonomic controls and mechanical functions in the body as a fundamental part of the body's homeostatic mechanisms. A long-term improvement in autonomic balance as well as in respiratory, cardiovascular and brain function can be achieved if mechanical forces are applied to the body with the aim of reducing existing imbalances of mechanical force vectors. This technique implies continually controlling the body functions for precise timings like in pranayamic breathing techniques (Kullok, 1990).

In our study we observed that valsalva ratio was increased in athlete as compared to sedentary of all age groups. Similarly Sharma and Deepak observed a numerical increase in valsalva ratio in 25 adult males who were trained for 15 days (Sharma, 2004). Komine suggested that regular endurance exercise in young men increases arterial baroreflex sensitivity through changes in the neural component of the baroreflex arc and not through alterations in vessel wall compliance of the carotid artery. Regular endurance exercise in young men increases arterial baroreflex sensitivity through neural alteration of baroreflex arc (Komine, 2009).

In present study significant negative correlation of valsalva ratio with age was observed in sedentary, athlete and yoga groups, which indicates reduced baroreflex sensitivity with age. Our results are in accordance with Storm *et al.*, and Shankar who demonstrated a significant reduction in valsalva ratio. Similar study by Gandhi and Singh reported progressive decrease in valsalva ratio suggested the involvement of parasympathetic activity with ageing (Storm, 1989; Gandhi, 2012). Islam *et al.*, (2008) observed the influence of aging process on parasympathetic nerve function and concluded that aging process substantially impaired cardiovascular parasympathetic nerve functions. Phillip *et al.*, (1997) evaluated autonomic function test in normal subjects evenly distributed by age and gender from 10 to 83 years and found valsalva ratio varied with age and gender.

Aging is known to alter the neurohormonal mechanisms that control the cardiovascular system. Published reports have demonstrated a decline in sinoatrial node parasympathetic activity. Previous studies have demonstrated that there is parasympathetic decline in elderly leading to impaired parasympathetic control of heart rate. Cardio vascular disturbances due to impaired parasympathetic control are usually subclinical and precede symptoms. (Islam, 2008)

Conclusion

In present study it seems that cardiovascular parameters alter with age but these alterations are slower in persons aging with yoga.

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