



Single session of integrated “silver yoga” program improves cardiovascular parameters in senior citizens

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ABSTRACT

Aim and Objective: This pilot study was carried out to determine cardiovascular effects of a single session of an integrated “silver yoga” program in senior citizens of Serene Pelican Township, Pondicherry. **Materials and Methods:** Heart rate (HR) and blood pressure (BP) measurements were recorded in 124 senior citizens (75 female, 49 male) with mean age of 67.19 ± 10.61 year who attended an integrated “Silver Yoga” program at Centre for Yoga Therapy, Education and Research from August to October 2014. Participants practiced the protocol that was specially designed for senior citizens, keeping in mind their health status and physical limitations. This included simple warm-ups (jathis), breath body movement coordination practices (kriyas), static stretching postures (asanas), breathing techniques (pranayamas), relaxation and simple chanting. Non-invasive BP apparatus was used to record the HR, systolic (SP) and diastolic pressure (DP) before and after the 60 min sessions. Pulse pressure (PP), mean pressure (MP), rate-pressure product (RPP) and double product (DoP) indices were derived from the recorded parameters. Student’s paired t-test was used to compare data that passed normality testing by Kolmogorov–Smirnov Test and Wilcoxon matched-pairs signed-ranks test for those that did not. $P < 0.05$ were accepted as indicating significant differences for pre-post comparisons. **Results:** All parameters witnessed a reduction following the single session. This was statistically more significant ($P < 0.0001$) in HR, RPP and DoP while it was also significant ($P < 0.01$ and $P < 0.05$) in SP and PP, respectively. The decrease in MP just missed significance ($P = 0.054$) while it was not significant in DP. **Conclusion:** There is a healthy reduction in HR, BP and derived cardiovascular indices following a single yoga session in geriatric subjects. These changes may be attributed to enhanced harmony of cardiac autonomic function as a result of coordinated breath-body work and mind-body relaxation due to an integrated “Silver Yoga” program.

KEY WORDS: Cardiovascular, psycho-somatic harmony, senior citizen, yoga

INTRODUCTION

Ageing is a natural process characterized by declining physical performance, slower speed of reaction, inadequate working of various systems with poor motor and sensory conduction. There is a progressive and generalized impairment of homeostasis resulting in declining ability to respond to external or internal stresses and increased risk of diseases [1]. The loss of adaptive response to stress increases risk of many age-related, degenerative disorders [2]. Dr. Dean Ornish, the renowned American physician and bestselling author who has shown that

a yogic lifestyle can reverse heart disease, says, “Yoga is a system of perfect tools for achieving union as well as healing” [3]. Dr. Ramamurthy, the eminent neurosurgeon, has observed that yoga practice reorients the functional hierarchy of the entire nervous system while benefiting cardiovascular, respiratory, digestive, and endocrine systems, in addition to bringing about many positive biochemical changes.

The practice of yoga has been shown to have preventive, curative as well as rehabilitative potential that can be explained on the basis of modulation of autonomic functions, stress reduction,

improvement in physiological functions and enhanced quality of life [4-6]. It has become quite apparent that yoga is a relatively low-risk, high-yield approach to improving overall health and wellbeing [7].

Yoga is qualitatively different from other modes of physical activity as it has a unique combination of isometric muscular contractions, stretching exercises, relaxation techniques, and breathing exercises. A recent report on the acute effects of one session of hatha yoga practice on blood pressure (BP) and other cardiovascular responses in healthy volunteers has showed that systolic (SP), mean (MP), and diastolic (DP) BP increased significantly during the yoga practice [8]. However, they did not compare pre-post effects of the entire session but focused only on the individual techniques used during the session. Very few studies have focused on immediate effects of a single yoga session, and these include one that investigated the effectiveness of a single 90-min hatha yoga class concluding that it significantly reduced perceived stress [9].

The only major report on effects of a single session of yoga, was a retrospective review of clinical data of 1896 patients done by us at Centre for Yoga Therapy, Education and Research (CYTER) in 2013 [10]. We found significant reductions in all the studied cardiovascular parameters following the yoga session. However, the magnitude of reductions differed in different groups of patients depending on pre-existing medical conditions as well as the specific yoga therapy protocol.

With the above in mind, this pilot study was done to determine cardiovascular effects of a single, 60-min, integrated “Silver Yoga” session in senior citizens of Serene Pelican Township attending regular sessions at CYTER.

MATERIALS AND METHODS

This pilot study was conducted at the CYTER functioning in Mahatma Gandhi Medical College and Research Institute of the Sri Balaji Vidyapeeth University, Puducherry, India. These sessions were carried out in the CYTER Yoga hall between 11 am and 12 noon on Thursdays in a quiet environment, with a comfortable temperature and subdued lighting. The participants had been advised to finish their breakfast at least 2 h earlier and come after emptying bowel and bladder.

Heart rate (HR) and BP measurements were recorded in 124 senior citizens (75 female, 49 male) with mean age of 67.19 ± 10.61 y who were attending an integrated “Silver Yoga” program at CYTER from August to October 2014. Participants practiced the protocol that was specially designed for senior citizens, keeping in mind their health status and physical limitations. This included simple warm-ups (jathis), breath body movement coordination practices (kriyas), static stretching postures (asanas), breathing techniques (pranayamas), relaxation and simple chanting. The complete protocol is given in Table 1.

Non-invasive BP apparatus was used to record HR, systolic pressure (SP) and diastolic pressure (DP) readings before and after the 60 min session. To ensure objectivity, all recordings

Table 1: Components of an integrated ‘Silver Yoga’ program

Jathis and kriyas (loosening techniques)
Standing asanas
Veera asana 1
Tada asana
Ardhakati and kati chakra asana
Ardha utkat asana
Sitting asanas
Vakra asana
Paschimottana/purvottana asana
Chatuspada kriya/vyagraha pranayama
Nava kriya
Face prone asanas
Bhujanga asana/bhujangini mudra
Makara asana
Supine asanas
Pawanamukta series
Pada uttana series
Sethu kriya
Pranayamas
Chandra nadi
Pranava
Bhramari
Mudras
Brahma mudra
Relaxation
Savitri pranayama in shava asana
Marmanasthanam/kaya kriya
Chakra awareness sequence

were performed using non-invasive automatic BP monitor (Omron HEM 7203, Kyoto, Japan) that uses oscillometric method with an instrumental accuracy of $\pm 5\%$ for HR and ± 3 mm Hg for BP. The pre-session recordings were taken after 5 min of quiet comfortable sitting while post-session recordings were taken at the end of the session. Pulse pressure (PP), mean pressure (MP), rate-pressure product (RPP) and double product (DoP) indices were derived from the recorded parameters.

Data were assessed for normality using GraphPad InStat version 3.06 for Windows 95, (GraphPad Software, San Diego California USA, www.graphpad.com). Student’s paired t test was used to compare data that passed normality testing by Kolmogorov-Smirnov Test and Wilcoxon matched-pairs signed-ranks test for those that didn’t. $P < 0.05$ were accepted as indicating significant differences for pre-post comparisons.

RESULTS

The results are given in Table 2. All cardiovascular parameters and derived indices witnessed a reduction following a single session of “Silver Yoga.” This was statistically very significant ($P < 0.0001$) in HR, RPP and DoP while it was also significant ($P < 0.01$ and $P < 0.05$) in SP and PP, respectively. The decrease in MP just missed significance ($P = 0.054$) while it was insignificant in DP.

DISCUSSION

There is a healthy reduction in HR, BP and derived cardiovascular indices following a single yoga therapy session. This implies a healthier autonomic regulation of the heart that may be

Table 2: HR, SP, DP, PP, MP, RPP and DoP before (B) and after (A) a single session of Silver Yoga

	B	A	P value
HR (bpm)	77.74±11.99	73.92±12.12	<0.0001
SP (mmHg)	131.93±13.63	128.97±14.34	0.0047
DP (mmHg)	71.63±11.83	70.94±11.52	0.4059
PP (mmHg)	60.30±12.48	58.03±13.00	0.0372
MP (mmHg)	91.73±10.98	90.28±10.93	0.0541
RPP (units)	103.20±22.51	95.60±20.57	<0.0001
DoP (units)	71.95±16.99	67.17±15.71	<0.0001

HR: Heart rate, SP: Systolic pressure, DP: Diastolic pressure, PP: Pulse pressure, MP: Mean pressure, RPP: Rate-pressure product, DoP: Double product, Student's paired *t*-test was used to compare data that passed normality testing by Kolmogorov-Smirnov test (SP, DP, PP, MP, RPP) and Wilcoxon matched-pairs signed-ranks test for those that didn't (HR and DoP). *P*<0.05 were accepted as indicating significant differences for pre-post comparisons

attributed to either an overall increase of parasympathetic tone and/or a reduction in sympathetic tone. As the RPP and DoP are indirect indicators of myocardial O₂ consumption and load on the heart, their reductions signify a lowering of strain on the heart that is beneficial for the senior citizens [11,12]. RPP also provides a simple measure of HR variability (HRV) in hypertensive patients and is a surrogate marker in situations where HRV analysis is not available [13]. Hence, reduction in RPP in our subjects is an indirect evidence of better cardiac autonomic modulation in them. The reduction of adrenergic tone coupled with normalization of parasympathetic tone is potentially very useful in this population as increased adrenergic tone has been implicated in precipitation of heart attacks. The elderly often have cardiac disorders with higher risk of heart attacks and strokes. Hence, such a program has potential benefits in prevention, management, and rehabilitation of such conditions.

One of the few earlier studies on acute effects of a single session of hatha yoga showed that SP, MP and DP increased significantly during the yoga practice [8]. Elevation in BP due to yoga practice was associated with increases in cardiac output (CO) and HR. This is similar to those changes observed in isometric exercise. However that study continuously measured HR, SP, DP, MP, stroke volume and CO. On the other hand we are evaluating the pre-post effects and hence are commenting on overall effects of the whole integrated practice session rather than the individual techniques. As suggested in our earlier report the conscious self-effort made in asana practice may be understood as the *spanda* (tension) component, whereas the relaxation of effort (*Prayatna shaithilya*) may be understood as the *nishpanda* (relaxation) component [10]. Hence, it is essential to physiologically evaluate the cardiovascular changes occurring not only during the actual performance of an asana, but maybe more importantly during and after period of recovery following it. We are supported in this assertion by a previous report by Telles *et al.* that concluded that a combination of stimulating and relaxing techniques reduced physiological arousal better than the mere practice of relaxation techniques alone [14]. They also pointed out that though the practical performance of yoga techniques seem to be stimulatory in nature, their physiological effects are, in fact, more relaxatory.

This is again corroborated by another report that shavasana relaxation is enhanced with the addition of savitri pranayama thus decreasing O₂ consumption by 26% [15].

In another study, we compared cardiovascular changes immediately after performance of different asanas and during the recovery phase [16]. In that study, there was a temporary rise of HR following dhanurasana due to relative difficulty of the posture. However cardiovascular recovery was found to be greater after performance of asanas when compared to merely relaxing in shavasana (a supine relaxation posture). This implies a healthier cardiac autonomic de-activation response when effort precedes relaxation.

We have also previously also studied the immediate effects of uninostrial breathing techniques in a geriatric population and reported that exclusive left nostril breathing (chandranadi pranayama) resulted in a decrease of cardiovascular parameters with a slowing down of the reaction time [17]. This is one of the techniques used in the present study and hence may have also contributed toward these positive cardiovascular relaxatory changes.

As the integrated "Silver Yoga" program was devised with the needs of the seniors in mind, it consisted of more breath-body work, breathing awareness and yogic relaxation. This may be the main factor behind the cardiac autonomic balance in our subjects irrespective of their initial condition. Yoga is defined as the state of balance (*samatvam yoga uchyate* - Bhagavad Gita) and the restoration of physical, mental, emotional and spiritual balance may be the prime factor behind the changes seen in our study.

Our findings are in agreement with a previous suggestion that yoga appears to modulate stress response systems by reducing perceived stress and anxiety, which in turn, decreases physiological arousal with decreases in HR and BP and respiration [18]. They also reiterate the results of our earlier retrospective study on 1896 patients where we found significant reductions in all the studied cardiovascular parameters following a single yoga session [10].

CONCLUSION

There is a healthy reduction in HR, BP and derived cardiovascular indices following a single yoga session in geriatric subjects. These changes may be attributed to enhanced harmony of cardiac autonomic function as a result of coordinated breath-body work and mind-body relaxation due to an integrated "Silver Yoga" program. We recommend that such an integrated Yoga program should be part of the health care facilities for the elderly as it can enhance their quality of life and improve their overall health status. Our study is limited by the fact that it only addressed immediate effects of a single session. Therefore, further studies on the effects of short and long-term training may deepen our understanding of the intrinsic mechanisms by which such positive changes are occurring. This would help strengthen our conclusion about the cardiovascular benefits of Yoga in a geriatric population.

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