

Yoga for Healthy Aging

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Abstract: *There was conducted comprehensive study of the influence of yoga in comparison to ayurveda (ancient Indian system of medicine) on age related health problems viz., physical, neurological and psychological measures in an elderly population. Subjects of research: of the 120 residents from a home for the aged, 69 were stratified based on age (five-year intervals) and gender and randomly allocated to three groups i.e., yoga, ayurveda (a herbal preparation), and wait-list control (no intervention). The groups were evaluated at baseline, and after three and six months of the respective interventions. The assessments included general health measures (pulmonary functions and anthropometric measurements), neurological (gait and balance, auditory perception, and autonomic functions) and psychological measures (depression scores and self rated sleep). Following six months of an integrated yoga practice (comprising of physical postures, voluntarily regulated breathing, guided relaxation, and meditation) there was a significant improvement in pulmonary functions, gait and balance, depression scores and the duration and quality sleep. The ayurveda group also showed improvements in pulmonary functions and gait, while the wait list control group showed signs of deterioration in pulmonary functions and mid arm circumference.*

Key words: *yoga, ayurveda, geriatric population, healthy aging*

Introduction

Human aging is a highly complex and variable experience that is influenced by numerous factors, intrinsic and extrinsic to an individual. Aging, in the sense of senescence, is a progressive loss of adaptability of an individual organism as time passes. The ability to react adaptively to challenges from the external (injury and infection) or internal environment (arterial occlusion and malignant cell clones) declines as an individual grows older. Since the homeostatic mechanisms become less sensitive, less well sustained, sooner or later everyone encounters a challenge which they are unable to deal with effectively and the person dies. Hence the rise of death rate with age has been recognized as the hallmark of senescence (Shrestha, 2000).

While the process of aging is inevitable, attempts are being made to convert the same into a pleasurable experience. Hence the concept of healthy aging has been adopted to identify interventions which can positively interfere with process of regular aging and to move an individual towards successful aging. Healthy aging is described as a state of low risk and high function in contrast to usual aging which is a non-pathologic state but at high risk (Rowe, Kahn, 1987). It was reported that healthy aging has three main components: (a) a low probability of disease and disease-related disability, (b) a high capacity for cognitive and physical functioning,

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and (c) an active engagement with life including interpersonal relations and productive activity (Rowe, Kahn, 2000).

Perhaps the complexity involved in understanding this process has resulted in identifying multiple interventions as health care strategies. For example, carbohydrate intolerance, osteoporosis and high blood pressure, all correlates of usual aging, can be modified by behavioral and life style interventions such as exercise, diet, and stress reduction (Schneider, Alexander, Salerno, Robinson, Fields, Nidich, 2002). Similarly, neurobehavioral aging, including cognitive decline was said to be not inevitable (Finch, 1987). According to gerontological experts, the health care and self-care strategies likely to be effective in facilitating the transition from usual to successful aging are interdisciplinary approaches that include behavioral, nutritional, biomedical and other interventions (Rowe, 1991; Steel, 1997; Swan, 1999).

A common thread between such interventions is the use of yoga based lifestyle modification. Yoga is an ancient Indian system of holistic living. It provides the most comprehensive approach for health promotion and disease prevention. Attempts have been made to understand the role of yoga in preventing or managing age related health problems. Majority of the studies have used single intervention for a single problem approach. Since the effects of combination of Yoga practices in healthy volunteers belonging to different age groups (except the elderly) are well understood, and the complex interplay between physical, physiological, psychological and behavioral sub systems results in normal/ accelerated aging, the present single blind randomized controlled trial was designed to evaluate the influence of an Integrated Yoga Module on a comprehensive test battery covering diverse aspects of age related health problems. This paper reviews the reported outcomes in detail.

Method

Subjects of the research were 120 inmates of a residential home for the aged, over the age of sixty years belonging to both sexes were examined. Thirty of them were ill or bed-ridden. The remaining 90 persons were told about the trial, i.e., those participants would be randomly allocated to: Yoga, Āyurveda or Wait-list control groups. All of them expressed their willingness to participate in the trial and the signed informed consent of each subject was taken. 90 subjects who expressed their willingness to participate in the trial were screened using: the electrocardiogram (all leads), fasting blood glucose, blood pressure measurements (using sphygmomanometer), and routine clinical examination.

Inclusion criteria: The subjects who had the following attributes were included in the study: (1) above the age of sixty years; (2) belonging to both sexes; (3) residing at the home for the aged for more than 6 months; (4) healthy on a routine medical examination and on screening and (5) willing to participate in the trial by giving a signed informed consent.

Exclusion criteria: Subjects with the following conditions were excluded from the trial: (1) chronic ailments; (2) disability or immobility; (3) unwillingness to participate in the trial. Following the detailed screening and routine clinical examination described above, subjects with the following health problems were excluded from the study: uncontrolled diabetes (seven participants), uncontrolled hypertension (four), neurological disorders (three), dementia (one), hearing impairment (five), and a detected case of non-infective Hansen's disease. Sixty nine subjects were included for the study after this screening.

Randomization: The 69 subjects were stratified according to age [five-year intervals, e.g., between 60 and 65 years (lower limit), and between 90 and 95 years (upper limit)]. Within a particular five-

year age range, subjects of each gender separately, were randomized as three groups by the investigator (i.e., Groups 1, 2 and 3) using a standard random number table (Zar, 1999).

Design of the Study

Subjects were assessed at baseline and after three and six months of their respective interventions (Yoga, Āyurveda, or Wait-list control). The individual who did randomization and data analysis was blinded. Hence, it was a single blind randomized controlled trial. The protocol was approved by the Institutional Ethical Committee (IEC) of Swami Vivekānanda Yoga Anusandhana Samsthana, Bangalore. The subjects were told about the aims and methods of the study and the informed consent was signed by all subjects

Assessments

A comprehensive battery of tests was designed which included different variables taken from the standard battery for the short term measurement of the rate of human aging (Comfort, 1969) and which came under three broad categories: (1) General health measures, (2) Neurological variables and (3) Psychological variables.

1. General Health Measures:

a) Pulmonary functions were studied using a computerized spirometer (Schiller Spirovit Sp-1, Switzerland). Each subject was given a demonstration about how to breathe during the following measurements: (1) Forced Vital Capacity (FVC), (2) Slow Vital Capacity (SVC), (3) Maximum Voluntary Ventilation (MVV) and (4) Minute Ventilation (MV).

b) Anthropometric measurements: The following anthropometric measurements were included: (1) Body Mass Index (BMI) and (2) Mid arm circumference.

2. Neurological Variables:

a) Autonomic and respiratory variables: A 4-channel polygraph (Medicaid Systems, Chandigarh, India) was used to record the electrocardiogram (EKG), respiration, and skin conductance level. *Skin Conductance Level (SCL):* Skin conductance was recorded using Ag/AgCl disc electrodes with electrode gel (Medicon, Madras, India), placed in contact with the volar surfaces of the distal phalanges of the index and middle fingers of the left hand. A low-level DC preamplifier was used and a constant voltage of 0.5V was passed between the electrodes. *Breath Rate:* Breath rate was recorded using a nasal thermistor clipped on to the more patent nostril. *Electrocardiogram (EKG):* The electrocardiogram was recorded using standard bipolar limb lead I configuration and an AC amplifier with 1.5 Hz high pass filter and 75 Hz low pass filter settings (Medicaid, Chandigarh, India).

b) The Tinetti balance and gait evaluation test: Balance and gait were assessed and scored individually in a 16-item test. The Tinetti balance and gait evaluation test required the subject to be seated in a hard chair without arms as support. Different maneuvers related to balance (9 items) and gait (7 items) were tested as per the procedure required to evaluate individual items (Tinetti, 1986). A score of 22 or less (total 28) indicated the risk of fall.

c) Audiometry: The auditory acuity of the subjects was measured using a computerized audiometer (Elkon Private Ltd., Mumbai; model – EDA 3N3 PLUS). Subjects were asked to sit in a sound dampened room. The audiometer was used to present subjects with pure tones of various

frequencies through acoustically shielded ear phones. At different frequencies (ranging between 500 Hz and 12 KHz), the threshold intensity was determined and plotted on a graph as a percentage of normal hearing (Ganong, 1987).

3. Psychological Variables:

a) Geriatric Depression Scale: The depression symptom scores of all three groups were assessed using the short version of the Geriatric Depression Scale (Sheikh, Yesavage, Raret, Lum, 1986) (GDS-S). It consists of 15 questions to determine how subjects felt over the past week. Each item is presented in a dichotomous format. The score range was between 0 to 15, with 0 = no depressive symptoms.

b) Sleep Rating Questionnaire: In the present sleep rating questionnaire there were seven questions, which subjects were asked to answer based on their experience during the week prior to assessment.

Data Analysis

Data were analyzed using the statistical package (SPSS Version 10.0). The repeated measures ANOVA was used to test for (1) significant differences between the assessments i.e., at baseline, three and six months (this was a Within-Subjects factor; Time) and (2) differences between the groups (Āyurveda, Yoga and Wait-list control), this was a Between-Subjects factor, and the test for a Time by Group interaction provided a global test for an intervention effect.

The t-test for paired data was used to compare data at three and six months with those at baseline of each group, separately.

Interventions

Yoga training: Yoga techniques include physical postures (*āsana*s), voluntarily regulated breathing (*pranayama*s), meditation, and philosophical principles which help to reach a balanced mental state. The session was for sixty minutes daily, for six days a week. Subjects practiced breathing exercises (10 min), loosening exercises (*sithilikarana vyayama*, 5 min), physical postures (*āsana*s, 20 min), voluntarily regulated breathing (*pranayama*, 10 min) and yoga-based guided relaxation (15 min). There was an additional session in the evening which consisted of devotional songs (*bhajans*, 15 min) and lectures on theory and philosophy of yoga alternating with 'cyclic meditation'.

Āyurveda: The herbal preparation of choice used in the present study is a rejuvenating tonic or *rasāyanā*s. As mentioned in an ancient *ayurveda* text, *rasāyana* as a measure, prolongs life and provides positive health, improves mental faculties and provides resistance and immunity against diseases (Chandramurthy, 2008) 10g of this preparation consisted of the following herbs (the Sanskrit names are given in parenthesis): *Withania Somnifera* (ashwagandha roots, 2g), *Embllica officinalis* (amalaki, 1g), *Sida Cordifolia* (bala, 0.25g), *Terminalia Arjuna* (arjuna, 0.25g), *Piper Longum* (pippali, 0.5g). The other contents were: sugar (4g), honey (2g), water and clarified butter (ghee) in the amount required to get the correct semi-solid consistency. The participants were given 10g (1 tablespoon, approximately) twice a day, once in the morning (6 a.m.) and again in the evening (6 p.m.) for 24 weeks.

The Wait-list Control group: The Wait-list Control group was not given any intervention but was told that they could receive either yoga or ayurveda after the trial. They were asked to continue with the normal routine of the home.

Results

The Repeated Measures ANOVA

General Health Measures: There was a significant difference between the groups for FVC and between the assessments for MVV and MV ($p < .01$). There was a significant difference in the assessments for the Mid arm circumference ($p < .05$).

Neurological Measures: There was a significant difference between the assessments ($p < .01$) and groups ($p < .05$) for Galvanic skin conductance, interaction between groups and assessments for respiratory rate ($p < .05$). Also, there was a significant difference between the assessments and groups in the measures of balance and the interaction between the assessments and groups for the measures of gait. There were no significant differences observed in the audiometric measurements for all frequencies ($p > .05$).

Psychological Measures: There was a significant difference between the assessments ($p < .001$), groups ($p < .05$) as well as the interaction between groups and assessments ($p < .001$) for depression scores. But there was no significant difference observed for aspects of self-rated sleep ($p > .05$).

't' test for paired data

General Health Measures: There was a significant increase in FVC and MV ($p < .05$) in the Yoga group while there was a decrease in FVC in the control group ($p < .01$). The Mid Arm Circumference decreased significantly in the Wait list control group after six months while the other two groups showed no change.

Neurological Measures: There was a significant reduction in heart rate ($p < .01$), respiratory rate ($p < .05$) and galvanic skin conductance ($p < .05$) in the yoga group. There was an increase in Galvanic skin conductance in the wait list control group ($p < .05$) after six months. With respect to the measures of gait and balance, there was a significant increase in the total scores ($p < .05$) in the yoga group while the other groups showed no change. The audiometric measurements were showed no change in the intervention groups while there was a significant reduction in the hearing frequency recorded at 500Hz in the wait list control group.

Psychological measures: There was a significant reduction in the depression scores in the yoga group ($p < .001$), while the other groups showed no change ($p < .05$). The time taken to fall asleep has reduced and the number of hours slept each night increased with an increased feeling of being rested in the morning ($p < .05$ for all comparisons) for the yoga group. The ayurveda and wait list control groups showed no significant change.

Discussion

Six months of yoga intervention has brought about significant improvements in general health measures, neurological and psychological variables in an elderly population. The wait list control group showed signs of deterioration in selected measures while the poor compliance to ayurveda intervention has resulted in no significant changes as observed in the present review.

As mentioned earlier, age related health problems can successfully be managed through multiple interventions. But no attempts were made to understand the collective influence of a comprehensive intervention on range of aging indices. The present study was an attempt and the results are in accordance with the earlier observations that yoga can influence gait (*DiBenedetto, Innes, Taylor, Rodeheaver, Boxer, Wright, Kerrigan, 2005*), autonomic functions (*Bowman, Clayton, Murray, Reed, Subhan, Ford, 1997*), memory (*Prakash, Rastogi, Dubey, Abhishek,*

Chaudhury, Small, 2012) and improve psychological wellbeing (*Haber, 1983*) in an elderly population. The specialty of the present study is in using a yoga package which has shown changes not only at physical level, but also at physiological and psychological levels.

While understanding the possible mechanisms underlying the changes reported in the present study, four major theories of aging can be considered i.e., (1) Inflammation leading to immunosenescence, (2) Oxidative stress resulting in cellular senescence and (3) Psycho-neuro-endocrine mechanisms resulting in organismal senescence and (4) Genetic factors and Telomere length resulting in gene senescence. It can be speculated based on earlier studies that the above mentioned mechanisms can be negated through Yoga based interventions.

A meditation technique that involves aligning breath, body movement and awareness for exercise has been shown to regulate immunity, metabolic rate and cell death by transcriptional regulation at genomic levels emphasizing the uniqueness with consciousness, cognition and spirituality (*Li, Li, Garcia, Johnson, Feng, 2005*), which factors are shown to be well regulated by yogic practices (*Gothe, Pontifex, Hillman, McAuley, 2012*). Inflammation and Inflammatory mediators produced in response to stress or as a result of the aging phenomenon causing a physiological distress is well known. Yoga practices in a long run has been shown to reduce inflammation below levels predicted by such key risk factors as age, abdominal adiposity, cardiorespiratory fitness and depressive symptoms in which study the potential inflammatory biomarkers, TNF alpha, CRP, IL6 and cortisol are all seen to be modified with practice of yoga (*Kiecolt-Glaser, Christian, Preston, Houts, Malarkey, Emery, Glaser, 2010*). Breath regulation in yoga which promotes diaphragmatic breathing correlates with reduced serum cortisol levels and lower oxidative stress levels (*Martarelli, Cocchioni, Scuri, Pompei, 2011*) and similar effect of reduced free radicals, malondialdehyde and increased glutathione (*Hegde, Adhikari, Kotian, Pinto, D'Souza, D'Souza, 2011*) and increased Super Oxide Dismutase (*Bhattacharya, Pandey, Verma, 2002*) have been documented with yoga practices.

Lifestyle factors known to promote diseases might adversely affect the telomere length & telomerase activity. Studies conducted on lifestyle modifications involving a low fat diet regimen, physical fitness and relaxation measures were capable of enhancing the telomerase activity and a significant maintenance was observed in the telomere length (*Ornish, Lin, Daubenmier, Weidner, Epel, Kemp, sar, 2008*). Similarly, a study conducted over a 3 months trial over a Buddhist meditation technique has shown to improve telomerase activity which was found to be proportionate to the psychological stress and negative emotionality (*Jacobs, Epel, Lin, Blackburn, Wolkowitz, Bridwell, 2011*) in agreement with the earlier findings as, stress resistance is directly proportional to an individual's ability to survive. There by, suggesting a hypothesis that a modality capable of combating the negative emotions and promotional mental wellbeing should be having an impact over the telomerase activity. Where, the role of Yoga in improving the psychological wellbeing and avoiding negative emotions are well studied and established (*Narasimhan, Nagarathna, Nagendra, 2011*).

Conclusion

Aging is a progressive, predictable process that involves the evolution and maturation of living organisms. While the process of aging is inevitable, the rate at which an individual ages can vary across individuals. Age related health problems and their management has become the major area of interest in the last decade as the demographic trends world over suggest a progressive increase in the number of individuals aged over 65+. Amongst several interventions tried, the use of yoga has become an important evidence based health care strategy for converting regular aging into healthy aging.

It is evident from the above mentioned literature that aspects of yoga can influence the process of regular aging and move an individual towards healthy aging featured by reduced risk of disease related disability and increased functional capacity. Hence the present review was an attempt to explore the wider applications of yoga in comparison to ayurveda in promoting healthy aging. Practicing yoga for six months can facilitate the process of healthy aging.

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