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Exploring the effects of yogasana and pranayama on cardiovascular health in middle-aged men

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Abstract
During physical activity, oxygen consumption (VO_2) has the potential to increase by more than 10 times, leading to a significant rise in oxidant production and consequent damage contributing to muscular fatigue during and post-exercise. Yoga, categorized as a form of physical activity, encompasses various health benefits. The research aimed to assess the impact of yogasana and pranayama on specific cardiorespiratory parameters in middle-aged men. A total of sixty male participants aged between 40 and 50 years, randomly chosen from diverse backgrounds, constituted the study. They were divided into three groups-yogasanas group, pranayama group, and control group-each comprising 20 subjects. The yogasana group practiced 8 specific yogasanas, while the pranayama group engaged in 5 prescribed exercises over a 12-week period. The control group remained untreated and strictly monitored. Cardiorespiratory parameters, including resting heart rate and maximal VO_2 (VO_2 max), were assessed before and after the experimental intervention across all groups. Discrepancies between initial and final scores were interpreted as the impact of asanas and pranayama on the selected cardiorespiratory parameters. Analysis of covariance results demonstrated that asanas and pranayama can positively influence cardiorespiratory parameters such as resting pulse rate and VO_2 max. The study concluded that middle-aged men can incorporate yogasanas and pranayama into their routine for enhancing and sustaining their cardiorespiratory health.

Keywords: Asana, cardiorespiratory parameters, maximal oxygen consumption, pranayama, resting pulse rate

Introduction

Cardiorespiratory fitness, also referred to as aerobic fitness or "cardio," encompasses the intricate interplay between the heart's enhanced pumping efficiency and the muscles' heightened oxygen utilization. As an individual attains greater aerobic fitness, the heart exhibits an augmented capacity to propel more blood and oxygen per beat, denoted as "stroke volume," while the muscles adeptly extract a more substantial quantity of oxygen. For instance, a conditioned muscle may efficiently consume 75 out of 100 oxygen molecules circulating in the bloodstream, in stark contrast to a deconditioned muscle, which might only utilize 30 or even fewer molecules. Consistent exercise optimizes these physiological systems by enlarging the heart muscle, facilitating increased blood pumping per stroke, and augmenting the network of small arteries in trained skeletal muscles, thereby enhancing blood supply to active muscles.

Individuals committed to cardiovascular-type training cultivate more efficient hearts, capable of delivering larger quantities of nourishment to working tissues with reduced stress on the cardiovascular system. Beyond boosting working capacity, regular aerobic training serves as a preventive measure against various diseases and disorders that may compromise the cardiovascular system. The benefits encompass a decrease in blood pressure, heightened levels of high-density lipoprotein cholesterol, reduced total cholesterol, diminished body fat stores, increased aerobic work capacity, alleviated symptoms of anxiety and stress, and enhanced heart function.

Entering middle age often manifests visible signs of aging, such as dwindling skin elasticity and graying hair. Physical fitness tends to decline, marked by a 5-10 kg (10-20 lb) accumulation of body fat, reduced aerobic performance, and a decline in maximal heart rate.

Strength and flexibility also witness a decrement throughout middle age. Despite these general trends, individual rates of aging vary significantly, and yearly mortality experiences a more noticeable uptick from age 40 onward, primarily due to age-related health issues like heart disease and cancer. Nevertheless, a majority of middle-aged individuals in developed nations can anticipate a long life, contrasting sharply with developing countries where life expectancy is lower, and the risk of death at all ages is higher, primarily due to cardiorespiratory fitness challenges.

Engaging in physical exercise triggers a remarkable increase in oxygen consumption (VO_2), exceeding a factor of ten. This surge leads to a substantial rise in oxidant production, contributing to muscular fatigue during and after exercise. The post-exercise inflammatory response is closely linked to oxidative stress, especially within the 24 hours following an exercise session.

Yogic techniques, including the practice of Pranayama, have been acknowledged for their holistic impact on overall performance. The ancient yoga sutras of Pathanjali delineate Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyan, and Samadhi as the eight integral components of yoga. In the contemporary materialistic world, Pranayama and Asana (Postures) stand out as pivotal aspects, even endorsed by modern medicine. Research substantiates the manifold benefits of yogasanas and pranayama, demonstrating a robust scientific foundation. Distinct types of pranayama yield various physiological responses in normal young volunteers, influencing cardiorespiratory and autonomic functions, and alleviating anxiety and stress.

While existing research has extensively reported the positive effects of yogasanas and pranayama, there remains a dearth of investigation into their impact on lipid profiles and subsequent effects on antioxidant status in young, healthy individuals. The current study aims to fill this research gap by examining the influence of yogasana and pranayama exercises on selected cardiorespiratory parameters in middle-aged men.

Table 1: Results on Calculation of ANCOVA

Calculation of ANCOVA on resting heart rate								
	Asanas Group	**Pranayama Group**	**Control Group**	**Source of Variance**	**Sum of Squares**	**df**	**Mean Squares**	**Obtained F**
Pre-test mean	72.25	74.55	72.95	Between	55.60	2	27.80	1.05
				Within	1509.65	57	26.49	
Post-test mean	70.05	71.30	72.85	Between	78.70	2	39.35	2.07
				Within	1083.70	57	19.01	
Adjusted post-test mean	70.86	70.25	73.09	Between	89.06	2	44.53	25.21*
				Within	98.91	56	1.77	
Mean diff	-2.20	-3.25	-0.10					
Calculation of ANCOVA on VO_2 max								
Pre-test mean	14.56	14.10	15.69	Between	26.60	2	13.30	0.01
				Within	68830.63	57	1207.55	
Post-test mean	18.30	16.45	15.70	Between	71.86	2	35.93	0.03
				Within	76013.55	57	1333.57	
Adjusted post-test mean	18.53	17.16	14.75	Between	146.71	2	73.36	7.34*
				Within	559.81	56	10.00	
Mean diff.	3.74	2.35	0.01					

Required F (0.05, 2.7)=3.15, *Significant, ANCOVA: Analysis of covariance, VO_2 max: Maximal oxygen consumption

Table 2: Scheffe's Post-hoc Analysis Results Post-hoc analysis for resting heart rate

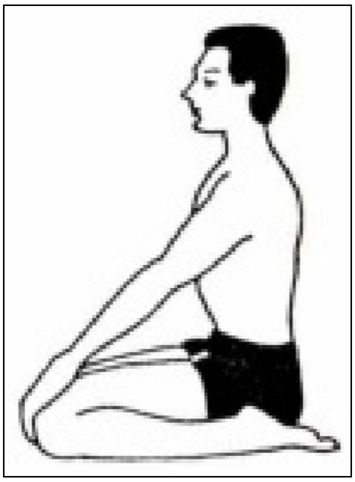
Asanas Group	**Pranayama Group**	**Control Group**	**Mean Difference**	**Reqd. C.I**
70.86	70.25		0.61	1.06
70.86		73.09	-2.23	1.06
	70.25	73.09	-2.84	1.06
Post-hoc analysis for VO_2 max				
18.53	17.16		1.37	2.51
18.53		14.75	3.78*	2.51
	17.16	14.75	2.41	2.51

*Significant

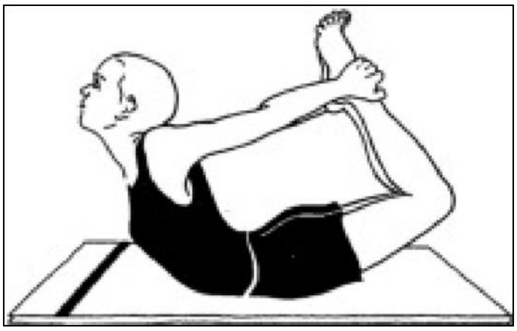
Method: In pursuit of its objective, a cohort of 60 middle-aged male subjects, whose ages ranged from 40 to 50 years, was judiciously and randomly selected from diverse walks of life. This pool of participants was then meticulously stratified into three distinct groups: the yogasanas group, the pranayama group, and the control group, each comprising 20 subjects. The yogasana group underwent a regimen encompassing Padmasana, Dhanurasana, Bhujangasana, Vajrasana, Matsyasana, Paschimottanasana, Ardha Chakrasana, and Sarvangasana over a span of 12 weeks. Simultaneously, the pranayama group engaged in Nadi Shodhana (Alternate Nostril Breathing), Sama Vritti Pranayama (Equal Breathing), Bhastrika Pranayama (Bellow Breath), Ujjayi Pranayama (Ocean Breath), and Kapalabhati Pranayama (Skull Shining Breath) for an equivalent duration. The control group, in stark contrast, remained untouched by any experimental interventions, adhering strictly to controlled conditions. Comprehensive assessments of selected cardiorespiratory parameters, encompassing resting heart rate and maximal VO_2 (VO_2 max), were conducted both pre- and post-experimental treatment across all three groups. The disparities between initial and final scores were scrutinized as indicative of the impact of asanas and pranayama on the selected cardiorespiratory parameters. Statistical analysis was undertaken utilizing analysis of covariance (ANCOVA), and where significant differences were discerned, post-hoc tests involving Scheffe's Confidence Interval were employed for the purpose of comparing differences between paired means.

Asanas

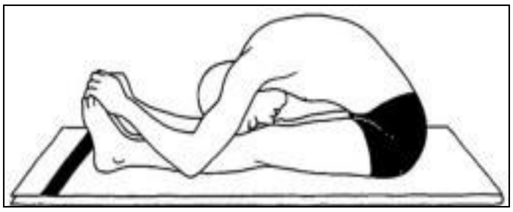
Padmasana



Vajrasa

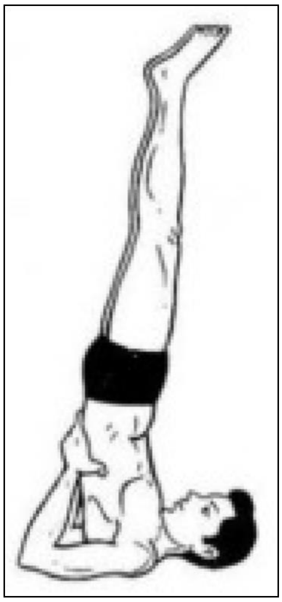


Dhanurasana

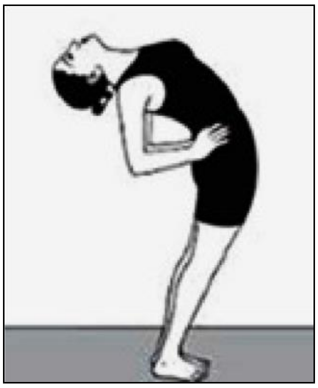


Paschimottanasana

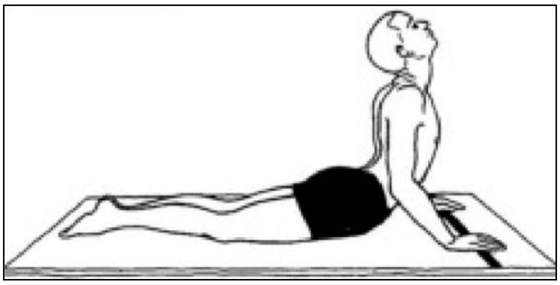
Matsyasana



Shirsasana



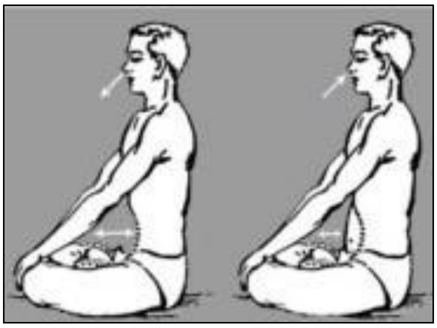
Ardha Chakrasana



Bhujangasana

Pranayama

Nadi Shodhana



Kapalabhati

Bhastrika Pranayama

Results
The findings obtained unequivocally substantiate that the 12-week yogasanas and pranayama treatments significantly moderated the resting pulse rate and VO_2 max ($p<0.05$). This assertion is grounded in the fact that the derived F values surpassed the requisite F value of 3.15 for significance. Post-hoc analysis further underscored the significance of paired mean differences between the asanas group and the control group, as well as the pranayama group and the control group, on resting pulse rate. Additionally, a discernible impact on VO_2 max was noted between the asanas group and the control group.

Discussion
The interventional programs, spanning 12 weeks of asanas and pranayama, yielded compelling evidence of their capacity to significantly alter cardiorespiratory parameters such as resting pulse rate and VO_2 max. Notably, there exists substantial empirical support for the contention that the adaptations resulting from yogasana and pranayama exercises encompass a fortification of the body's antioxidant defenses, particularly the glutathione system, to regulate heightened oxidative stress, as posited by Leeuwenburgh *et al*. (1994) [6]. Consistent with these findings, the present study aligns with the observations of Bhattacharya *et al*. (2002) [5], who reported significant influences on cardiorespiratory parameters stemming from the practice of yoga.

Conclusions
The findings of this study incontrovertibly demonstrate that yogasanas and pranayama play a pivotal role in eliciting beneficial effects on cardiorespiratory variables among middle-aged men. As a forwardlooking proposition, future research endeavors could encompass diverse profiles to glean more nuanced and accurate insights into the influences of yogasana and pranayama.

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