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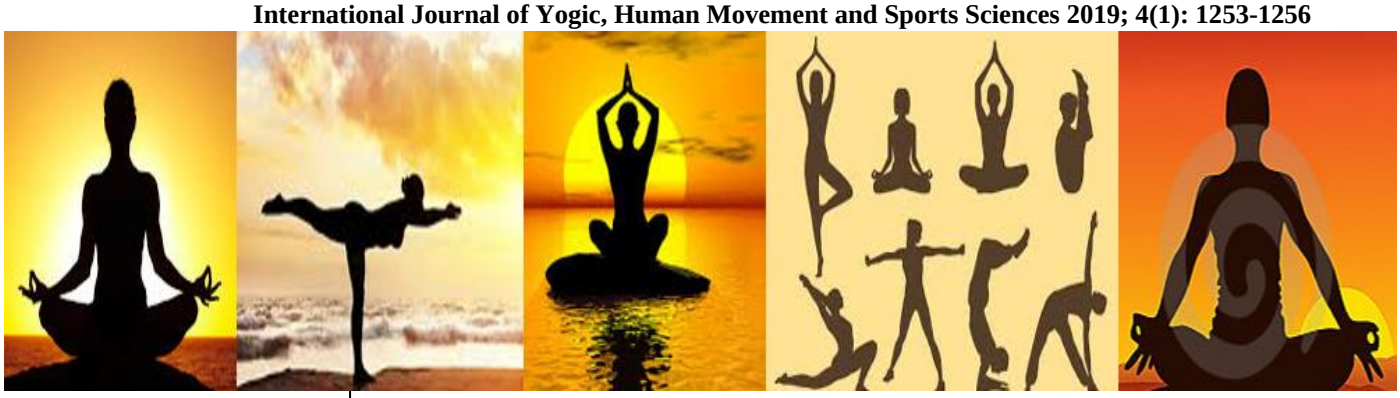

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Comparative effect of yoga practices and aerobic exercises in altering the mean arterial pressure of untrained men

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Abstract
The purpose of the study was to compare the effect of yoga practice and aerobic exercises in altering the Mean arterial pressure (MAP) of untrained men. To achieve the purpose of the study the investigator selected forty five untrained men as subject in the age group of 40 years to 45 years. They were divided into three equal groups of fifteen each (n=15) at random. Group-I performed yoga practice, group-II performed aerobic exercises and group-III acted as control. Training programme was administered to the untrained men for twelve weeks with six training units per week. ANCOVA was used to find out the adjusted mean difference between the groups. The result of the study reveals that due to the effect of yoga practices and aerobic exercises the Mean arterial pressure of the subjects was significantly improved. It is also concluded that yogic practices was significantly better than aerobic exercises in altering mean arterial pressure of untrained men. It produced 3.61% percentage of changes in mean arterial pressure due to yogic practices, 1.57% of changes due to aerobic exercises and 0.53% of changes in control group.

Keywords: Yoga practice and aerobic exercises, Mean arterial pressure

Introduction
Mean arterial blood pressure (MAP) is considered the perfusion pressure seen by organs in the body. It is believed that a MAP of greater than 60 mmHg is enough to sustain the organs of the average person under most conditions. If the MAP falls significantly below this number for an appreciable time, the end organ will not get enough blood flow, and will become ischemic. As blood is pumped out of the left ventricle into the arteries, pressure is generated. Mean arterial pressure is regulated by changes in cardiac output and systemic vascular resistance.

Mean arterial blood pressure increases in response to dynamic exercise, largely owing to an increase in systolic blood pressure, because diastolic blood pressure remains at near resting levels. Systolic blood pressure increases linearly with increasing rates of work, reaching peak values of between 200 and 240 mmHg in normotensive persons. Because mean arterial pressure is equal to cardiac output times total peripheral resistance, the observed increase in mean arterial pressure results from an increase in cardiac output that outweighs a concomitant decrease in total peripheral resistance. This increase in mean arterial pressure is a normal and desirable response, the result of a resetting of the arterial baroreflex to a higher pressure. Without such a resetting, the body would experience severe arterial hypotension during intense activity (Rowell, 1993) [13].

It is a common misconception that yogic exercises are physical exercises. But the basic differences of yoga and exercises are words, that are often confused as one and the same, there is a lot of difference between the two words. Yoga is a School of philosophy whereas exercise pertains to the development muscles of the human body by training them properly. The performance of yoga postures does not contribute to the development of muscles, whereas exercising the body in the gym contributes a lot to the toning of the muscles. Yoga aims at the attainment of mental purity. It is all about the regulation of breathing technique called Pranayama and asnas postures.

Exercise aims at building up stamina on the other hand yoga needs regular practice to attain perfection. Yoga must have a Guru or a Teacher to impart the knowledge of yoga to you. On the other hand one need not learn exercises from a trainer. These are some of the differences between yoga and exercises. Exercise is also a type of physical activity, but there is the intent and purpose of improving certain aspects of health. Exercise is planned physical activity that leads to visible improvement in health and general well-being. Aerobic exercises are repetitive movements whereas yoga exercise involves very little movement and only postures maintained for a period of time. Aerobic exercises lay emphasis on strong movements of muscles whereas yoga opposes violent movements.

Yogic postures tone up the body and the mind whereas aerobic exercise affects mainly the body. The caloric requirement in yogic asanas varies from 0.8 to 3calories per minute while the caloric requirement of a physical exercise varies from 3 to 20 calories per minute. The main purpose of aerobic exercise is to increase the circulation of the blood and the intake of oxygen. This can be done by yoga's simple movements of the spine and various joints of the body with deep breathing, but without violent movements and asanas, the various blood vessels are pulled and stretched and blood is equally distributed to every part of the body. The stretch and blood is equally distributed to every part of the body. The stretched muscles and ligaments during yoga practices are immediately relaxed muscles. Fatigue appears after doing physical exercises.

Physiological functions of the body may be improved by exercise. In order to assess the training impact on mean arterial pressure among untrained men, the investigator selected yoga practice and aerobic exercises as the independent variable. Information related to the impact of yoga practice and aerobic exercises among untrained men is scanty. So the present study is planned.

Methodology

Selection of Subject and Variable

To achieve the purpose of the study the investigator proposed to select forty five untrained men as subject in the age group of 40 years to 45 years. They were divided into three equal groups of fifteen each (n=15) at random. Group-I performed yoga practice, group-II performed aerobic exercises and group-III acted as control. All the subjects selected for the experimental treatment was subjected to medical evaluation and certification from a doctor ensuring their health capacities to undergo the training program. Mean arterial pressure was selected as dependent variable and it was assessed by using digital blood pressure monitor.

Training Programme

Training programme was administered to the untrained men for twelve weeks with six training units per week. The experimental group-I performed yoga practice and group-II performed aerobic exercises. During the training period, the experimental group-I underwent yoga practices six days a week for twelve weeks. The Yogasana exercise included in this training programme were Sugasana, Vajrasana, Viparitakarani, Sarvangasana, Bhujangasana, Matsyasana, Ardhamatsyendrasana, Trikonasana, Vrksasana, and Savasana respectively. The training programme was conducted in the morning sessions from 6 `O`clock onwards. In the present study, the aerobic exercise protocol consisted of three set of fourteen aerobic exercises, starting with slow followed by fast repetitions. Repeated exercises were performed, alternating left and right sides. To fix the training load for the experimental groups the subjects were examined for their exercise heart rate in response to different work bouts, for proposed repetitions and sets, alternating with active recovery based on work-rest ratio. The subject's training zone was computed using Karvonen formula and it was fixed at 50%HRmax to 80%HRmax.The work rest ratio of 1:1 between exercises and 1:3 between sets was given.

Collection of the Data

The pretest data was collected prior to the training programme and posttest data was collected immediately after the twelve weeks of yoga practice and aerobic exercises, from the experimental groups and a control group.

Experimental Design and Statistical Technique

The data collected from the three groups prior to and post experimentation on selected dependent variable was statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). Since three groups are involved, whenever the obtained 'F' ratio value was found to be significant for adjusted post test means, the Scheffe's test was applied as post hoc test to determine the paired mean differences, if any. In all the cases the level of confidence was fixed at 0.05 for significance.

Result

The descriptive analysis of the data showing mean and standard deviation, range, mean differences, 't' ratio and percentage of improvement on mean arterial pressure of experimental and control groups are presented in table-1.

Table 1: Descriptive Analysis of the Pre and Post Test Data and 'T' Ratio on Mean Arterial Pressure of Experimental and Control Groups

Group	Test	Mean	Standard Deviation	Range	Mean Differences	't' ratio	Percentage of Changes
Yogic Practices Group	Pre test	97.21	5.45	9.04	3.51	9.60*	3.61%
	Posttest	93.70	4.47	7.43			
Aerobic Exercise Group	Pre test	98.25	3.23	7.34	1.54	8.06*	1.57%
	Posttest	96.72	4.54	7.07			
Control Group	Pre test	98.19	5.28	8.33	0.52	1.00	0.53%
	Posttest	97.67	5.26	8.00			

Table t-ratio at 0.05 level of confidence for 14 (df) =2.15

Table- 1 show that the mean, standard deviation, range and mean difference values of the pre and post test data collected from the experimental and control groups on mean arterial pressure. Further, the collected data was statistically analyzed by paired 't' test to find out the significant differences if any between the pre and post data. The obtained 't' values of yogic practices and physical exercises groups are 9.60 and 8.06 respectively which are greater than the required table value of 2.15 for significance at 0.05 level for 14 degrees of freedom. It revealed that significant differences exist between

the pre and post test means of experimental groups on mean arterial pressure.

The result of the study also produced 3.61% percentage of changes in mean arterial pressure due to yogic practices, 1.57% of changes due to aerobic exercises and 0.53% of changes in control group.

The pre and post test data collected from the experimental and control groups on mean arterial pressure is statistically analyzed by using analysis of covariance and the results are presented in table–2.

Table 2: Analysis of Covariance on Mean Arterial Pressure of Experimental and Control Groups

	Yogic Practices Group	Aerobic Exercises Group	Control Group	SoV	Sum of Squares	Df	Mean squares	'F' ratio
Adjusted Post-test Mean	94.22	96.44	97.44	B	78.93	2	39.46	21.20*
				W	76.31	41	1.86	

(Table value required for significance with degrees of freedom 2 & 42, 2 & 41 is 3.23)
*Significant at 0.05 level of confidence

The adjusted post-test means on mean arterial pressure of yogic practices, aerobic exercises and control groups are 94.22, 96.44 and 97.44 respectively. The obtained 'F' value of 21.20 on mean arterial pressure is greater than the required table value of 3.23 for the degrees of freedom 2 and 42 at 0.05 level of confidence. Hence, it was concluded that significant differences exist between the adjusted post test means of yogic practices, aerobic exercises and control groups on mean arterial pressure.

Since, the obtained 'F' value in the adjusted post test means is found to be significant, the Scheffe' s test is applied as post hoc test to find out the paired mean difference, and it is presented in table-3.

Table 3: Scheffe's Post Hoc Test for the Differences among Paired Means of Experimental and Control Groups on Mean Arterial Pressure

Yogic Practices Group	Aerobic Exercises Group	Control Group	Mean Difference	Confidence Interval
93.87	95.70		1.83*	1.27
93.87		97.90	4.03*	1.27
	95.70	97.90	2.20*	1.27

*Significant at 0.05 level

The Scheffe' s post hoc analysis proved that significant mean differences existed between yogic practices and aerobic exercises groups, yogic practices and control groups, aerobic exercises and control groups on mean arterial pressure. Since, the mean differences 1.83, 4.03 and 2.20 are higher than the confident interval value of 1.27 at 0.05 level of significance. Hence, it is concluded that due to the effect of yogic practices and aerobic exercises the mean arterial pressure of the subjects is significantly changed. It is also concluded that yogic practices was significantly better than aerobic exercises in altering mean arterial pressure.

The pre, post and adjusted post test mean values on mean arterial pressure of experimental and control groups is graphically represented in figure-I.

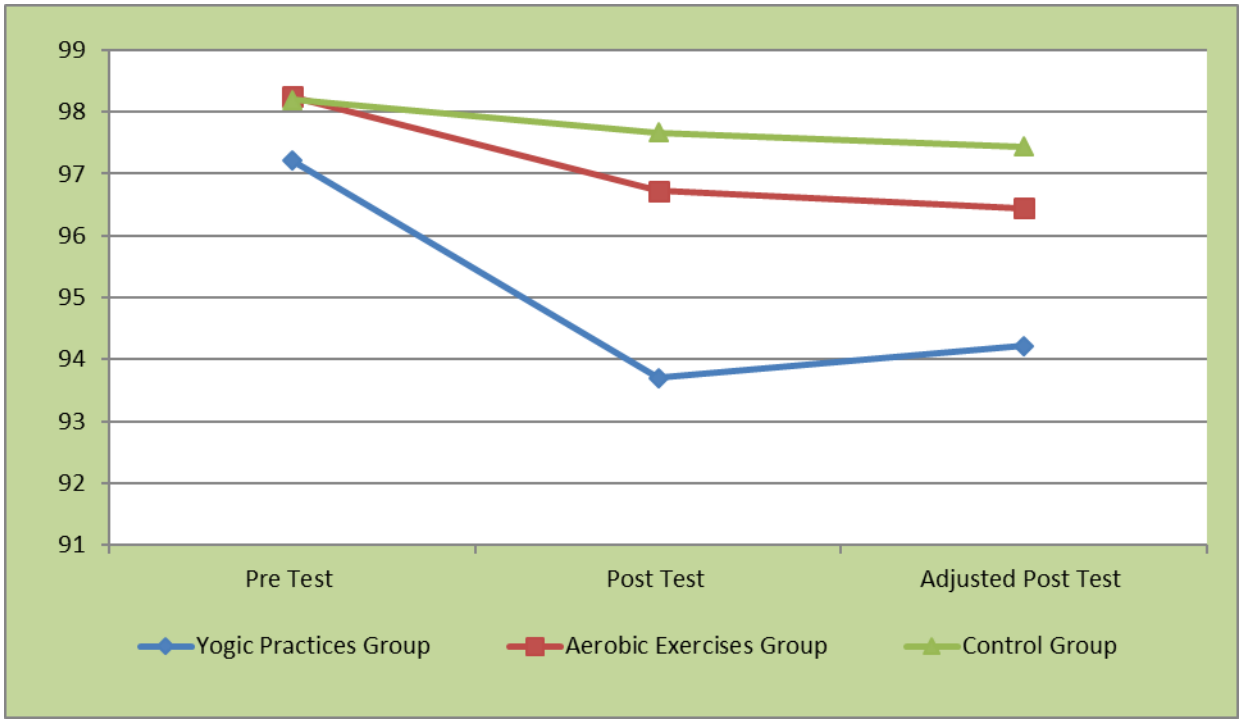

Fig I: Diagram Showing the Pre, Post and Adjusted Post Test Mean Values on Mean Arterial Pressure of Expert mental and Control Groups

Discussion

Yogic practices demonstrated a significant difference in heart rate, with breathing practices and asanas lowering heart rate significantly so yogic practices into a lower-impact workout may be beneficial. Chaya *et al*., (2008) [3] reported that long-term practice of yogic asanas along with pranayama and

meditation causes reduced sympathetic activity resulting in reduced metabolic rate and greater metabolic efficiency in yoga practitioners. Hagins *et al*., (2007) [10] suggested that yoga is a mind-body practice where practice of physical postures is combined with control of breathing, meditation along with stretching exercise, isometric exercise, and dynamic exercises of skeletal muscles. Raub (2002) [12] find that Practice of hatha yoga may help control such physiological variables as blood pressure, respiration, HR and metabolic rate to improve overall exercise capacity.

Regular practice of yoga helps to keep our body fit, controls cholesterol level, reduces weight, normalizes blood pressure and improves heart performances. Regular exercise results in an increase in the blood flow and improves oxygen carrying and waste removal capacity and further increases work load capacity (Vitale, 1973) [15]. Exercise increases the volume of hemoglobin and erythrocyte of the blood. Also blood vessels are seen to maintain elasticity and suppleness when stressed systematically probably by the beneficial effect of the heart.

Arterial blood pressure at rest, blood pressure during submaximal exercise, and peak blood pressure all show a slight decline a result of endurance training in normotensive individuals (Fagard & Tipton 1994) [8]. However, decreases are greater in persons with high blood pressure. After endurance training, resting blood pressure (systolic/diastolic) will decrease on average 3/3 mmHg in persons with normal blood pressure; in borderline hypertensive persons, the decrease will be 6/7 mmHg; and in hypertensive persons, the decrease will be 10/8 mmHg (Fagard& Tipton, 1994) [8].

Balducci *et al*., (2010) [1] assessed the efficacy of an intensive exercise intervention strategy and found exercise produced significant improvements in systolic and diastolic blood pressure. Mean arterial blood pressure increases in response to dynamic exercise, largely owing to an increase in systolic blood pressure, because diastolic blood pressure remains at near-resting levels. Systolic blood pressure increases linearly with increasing rates of wok, reaching peak values of between 200 and 240 milli meters of mercury in normotensive persons. Because mean arterial pressure is equal to cardiac output times total peripheral resistance, the observed increase in mean arterial pressure results from an increase in cardiac output the outweighs a concomitant decrease in total peripheral resistance.

Gillett and Elsenman (1987) [9] in their study determined the effect of 16 weeks aerobic dance programme and was concluded significant improvement in the physiological variables such as breath holding time and heart rate. Wool May *et al*., (1998) [16] conclude that 18 week walking programme appeared to improve aerobic fitness, there was no evidence of improvements in the blood lipids or associated apolioproteins of the walking groups. Dengel *et al*., (1998) [7] observed that six month programme of aerobic exercise training plus weight loss intervention substantially lower BP and improves glucose and lipid metabolism in obese, sedentary, hypertensive men.

Conclusion

The result of the study reveals that due to the effect of yoga practice and aerobic exercises the mean arterial pressure of the subjects was significantly changed. It was also concluded that yogic practices significantly better than aerobic exercises in altering mean arterial pressure of untrained men. The result of the study also produced 3.61% percentage of changes in mean arterial pressure due to yogic practices, 1.57% of changes due to aerobic exercises and 0.53% of changes in control group.

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