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Experiment

Effects of Yoga Practice on Cardiovascular & Respiratory Parametersin Professional Athletes.

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A B S T R A C T

This study explores the impact of yogic practices on selected physiological variables among adolescent sportspersons, aiming to provide a comprehensive understanding of how regular engagement in yoga can influence physiological profiles. The research focuses on a 3-month yogic intervention involving 60 adolescent sportspersons, aged 13 to 19, who underwent a structured yoga program specifically tailored to their age group. The intervention targeted key physiological variables, with data on pulse rate and oxygen saturation levels collected at the beginning and end of the intervention period.

Using the paired t-test for statistical analysis, the study examined changes in these physiological parameters over the course of the 3-month intervention. The results demonstrated significant improvements in both pulse rate and oxygen saturation, indicating that sustained engagement in yogic practices can lead to substantial physiological benefits for adolescent athletes. These findings underscore the potential of yoga as a holistic approach to enhance athletic performance by optimizing physiological function.

The research contributes valuable insights into the role of yoga in sports training, suggesting that it can be an effective complementary strategy for improving physiological outcomes in adolescent sportspersons. The study's results advocate for the integration of yoga into sports training programs, highlighting its potential to support the overall physical development and performance of young athletes.

Introduction

Physiology, the study of the body's functional processes, plays a critical role in understanding performance outcomes. Physiological variables play a crucial role in determining an individual's performance level. While natural ability offers potential but mastering the basics is key to achieving excellence. Professional trainers advocate for a holistic approach, focusing not only on enhancing athletic performance but also on developing the athlete's overall physical and psychological profile. Consequently, excelling in modern sports requires a more scientific and technical approach to training and development (Singh, 2019).

Sports performance is heavily influenced by both physical fitness and the athlete's physiological condition. Achieving excellence in sports is unattainable without well-developed physiological factors. These variables, along with physical fitness, serve as reliable indicators of an individual's athletic performance potential. Moreover, the body's physiological systems are highly adaptable to exercise, responding and improving with consistent training (Bachman & Horvath, 2013). The

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assessment of pulse rate, breathing frequency, blood pressure, and muscle tension during various yogic exercises indicates that yoga is a distinctive form of exercise that positively impacts the body while minimizing physical strain (Kollak, 2009).

Pulse rate is frequently monitored in athletic assessments, particularly during interval training or activities (Winter et al., 2006). The pulse is a pressure wave that travels through the arteries, and the pulse rate refers to the number of these waves produced by the heart with each beat, detectable at the arterial walls (Borg-Olivier & Machliss, 2013).

Oxygen saturation measures the percentage of hemoglobin bound to oxygen in the blood, compared to unbound hemoglobin. Oxygen consumption peaks during physical activity and is lowest at rest. The body tightly regulates oxygen levels, as hypoxemia can cause acute and chronic harm to vital organs, including the brain, heart, and kidneys (Ceylan et al., 2016). Oxygen is a vital nutrient for the body, essential for the proper functioning of organs such as the brain, nerves, glands, and other internal systems. Regular respiratory exercises strengthen the lungs, boost blood circulation, and contribute to improved overall health and vitality (Pant & Dhapola, 2017).

Yoga has become a widely popular practice for athletes, children, and seniors alike. It can be adapted to suit all fitness levels, promoting overall health. The positive impact of yoga on physical well-being and cardio-respiratory fitness is well-established (Huang et al., 2013). Yoga has long been regarded for its positive influence on both physical and emotional health (Gilbert, 1999). Studies indicate that yoga practice can act as a psycho-physiological stimulus, boosting melatonin production, which may play a key role in promoting well-being and enhancing feelings of happiness (Harinath et al., 2004). Research indicates that yoga can be as effective as, or even surpass, traditional exercise in enhancing various health-related outcomes (Ross & Thomas, 2010).

Yoga, an ancient practice with roots in Indian philosophy, is increasingly recognized for its potential benefits in enhancing physical performance and overall well-being. This research explores the impact of yoga on cardiovascular and respiratory parameters among professional athletes. With rigorous physical training being a cornerstone of athletic success, understanding how complementary practices of yoga can influence key physiological metrics—such as heart rate and oxygen saturation—is crucial. By integrating yoga into their regimens, athletes may experience improvements in their cardiovascular efficiency and respiratory function. This study aims to provide empirical evidence on these effects, offering insights into how yoga can be effectively incorporated into athletic training programs to optimize performance and health.

Few Literatures Review

A study orchestrated by (Milli & Srinivasa, 2022) on female college students aged 18-22 demonstrated that six months of yoga significantly reduced pulse rate, systolic blood pressure, and diastolic blood pressure. These findings suggest that regular yoga practice can effectively improve cardiovascular health and lower the risk of related diseases. (Kaleeswari et al., 2021)examined the effects of a 6-week yoga intervention, including pranayama and meditation, on 40 women, showing significant reductions in blood pressure and pulse rate. The findings suggest that yoga can be a beneficial approach for managing these parameters in patients with chronic conditions. (Beutler et al., 2016) compared yogic individuals with non-yogic controls and found that yoga practitioners exhibited altered respiratory regulation, including higher tidal volume at rest and a reduced ventilatory response to hypercapnia. However, despite these differences in respiratory function, yoga did not significantly improve endurance capacity or exercise ventilation. On the other hand, (Sil, 2021) study found that four weeks of yoga practice was insufficient to produce significant changes in systolic and diastolic blood pressure, resting heart rate and arterial oxygen saturation in the target group. This suggests that a longer duration of practice may be required for noticeable physiological improvements.

Materials & Methods

To conduct this study, sixty sportspersons (N=60) were randomly selected as the experimental group from the Sports Training Center of the Sports Authority of India, located in Sangrur, Punjab. The participants, all of whom were between the ages of 13 and 19, were drawn from the academic year 2022. Throughout the study period, participants were allowed to engage in other training activities. The experimental group underwent a structured yogic exercise program, which was conducted for six days a week, excluding Sundays, over a span of 12 weeks. Each session of the yogic exercise lasted approximately 30 minutes, with the training regimen extending for a total of three months. Training session of this study includes some yogic practices such as: Asana (Vajrasana, Gomukhasana, Vakrasana, Ardhhalasana), Pranayama (Kapalbhati, Ujjai, Bhastrika), Meditation (Om Chanting) and Relaxation (Shavasana, Makarasana) were given after their morning sports training.

Criterion Measures

The study assessed the physiological variables of pulse rate and oxygen saturation using specific measurement criteria. A pulse oximeter was employed as the primary instrument for collecting the physiological data. The data collection was conducted by a senior lab technician from Sharma Laboratory in Sangrur, Punjab, ensuring reliability and accuracy for the study's purposes. The investigator administered all test items once the participants were fully familiar with the testing procedures and methodology. Physiological variables were measured at two points: before the commencement of the training program (pre-test) and after its completion (post-test).

Analysis & Interpretation

To assess the effects of yogic exercises on the physiological variables of sportspersons, data were meticulously gathered from a sample of 60 participants. The study aimed to analyze the differences between pre-test and post-test results following the yogic intervention. For this purpose, statistical techniques including the calculation of the Mean, Standard Deviation, and paired t-test at a 0.05 significance level were employed to determine the significance of any observed changes. The data analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 20, ensuring robust and reliable statistical processing. The results are comprehensively presented through detailed tables and graphs, illustrating the variations in physiological variables before and after the intervention. These visual and numerical representations provide clear insights into the efficacy of the yogic exercises in influencing the physiological parameters of the sportspersons.

Table No. 1	Data	N	Mean	S D	M D	t-value	p-value
Pulse Rate	Pre-Data	60	80.82	8.89	0.00	0.00	1.0
	Post-Data	60	80.82	5.52			

**Significant at 0.05level (p<0.05)*

Table No.1 displays the comparative analysis of pulse rates before and after the yogic intervention among 60 participants. Both the pre-test and post-test mean pulse rates are identical at 80.82. The decrease in standard deviation from 8.89 in the pre-test to 5.52 in the post-test suggests that while the average pulse rate remained the same, the variation in pulse rates among participants decreased after the intervention. This could imply that participants' pulse rates became more stable and consistent as a result of the yogic exercises. The mean difference of 0.00 and the t-value of 0.00 indicate that there was no observable change in pulse rate between the pre-test and post-test conditions. This lack of change is statistically supported by the t-test results. The p-value of 1.0 is far above the significance level of 0.05, indicating that the differences observed in the study are not statistically significant.

Therefore, the yogic intervention did not have a significant effect on the pulse rate of the adolescent sportspersons involved in the study. Despite the unchanged mean pulse rate, the reduced standard deviation suggests a potential stabilization of pulse rates among participants. However, based on the p-value, these changes are not statistically significant, meaning the intervention did not have a measurable effect on this particular physiological variable within the study's parameters.

Table No. 2	Data	N	Mean	S D	M D	t-value	p-value
Oxygen Rate	Pre-Data	60	96.28	3.41	2.09	4.95	.0001**
	Post-Data	60	98.37	1.22			

**Significant at 0.05level (p<0.05)*

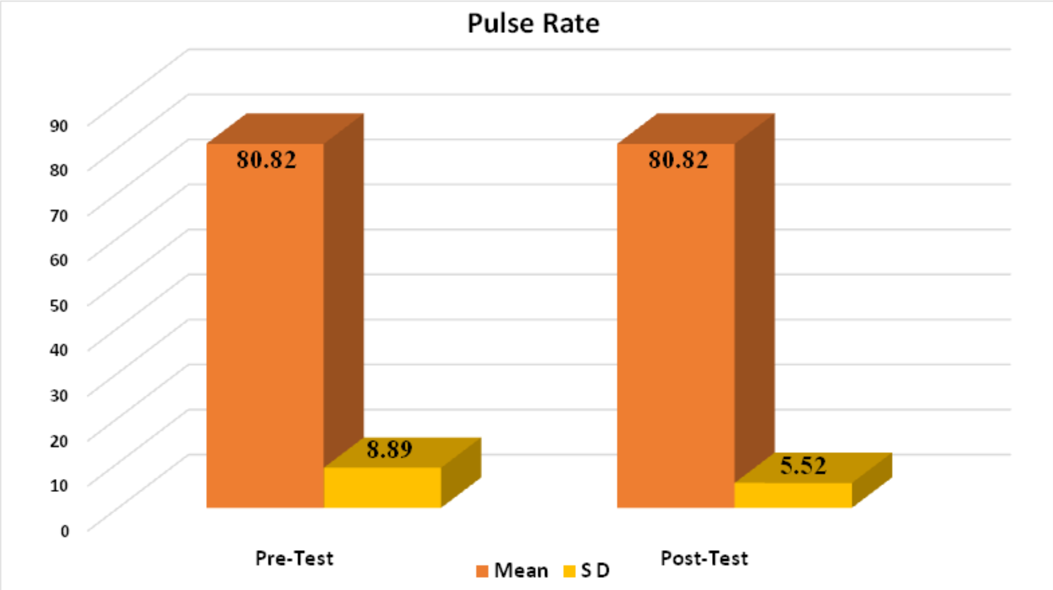
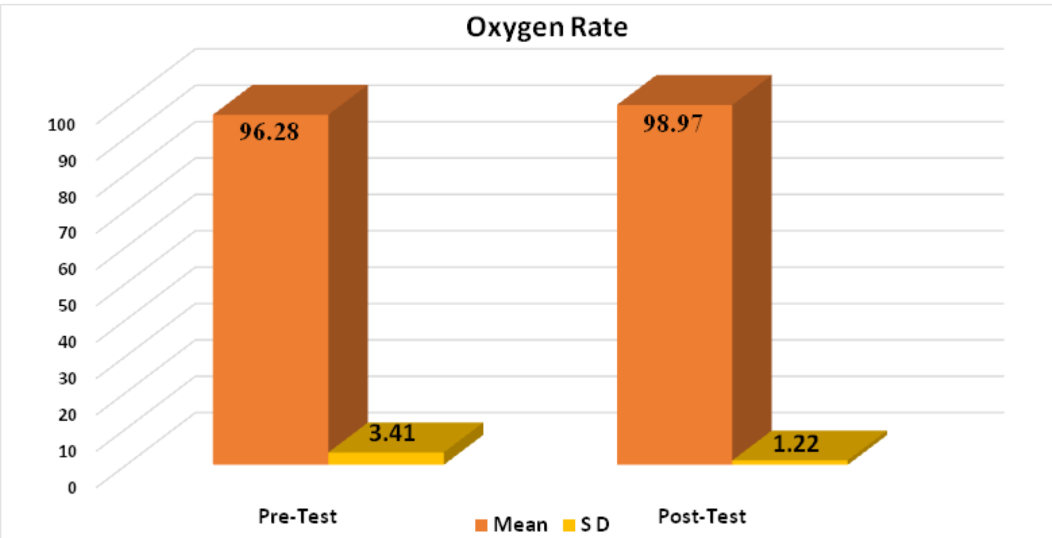


Table No.2 displays the comparative analysis of oxygen rates before and after the yogic intervention among 60 participants. The mean oxygen saturation rate increased from 96.28 before the intervention to 98.37 afterward. The decrease in standard deviation from 3.41 in the pre-test to 1.22 in the post-test indicates that the oxygen saturation rates among participants became more consistent after the yogic intervention. This reduced variability implies that the participants' oxygen levels stabilized and improved as a group. The mean difference of 2.09 shows a noticeable improvement in oxygen rates following the intervention. The t-value of 4.95 further supports this finding, indicating that the change in oxygen rates between the pre-test and post-test is statistically significant. The p-value of .0001 is significantly below the 0.05 threshold, confirming that the observed increase in oxygen saturation rate is statistically significant. This means the improvement in oxygen levels is likely due to the yogic intervention rather than random chance.

Therefore, increase in the mean oxygen rate, coupled with a significant t-value and a highly significant p-value (.0001), suggests that the intervention effectively enhanced the participants' physiological capacity for oxygen uptake and utilization. This finding highlights the potential benefits of incorporating yogic practices into sports training programs to improve respiratory function and overall physiological health.



The present study assessed the effects of a yogic intervention on pulse rate and oxygen saturation among adolescent sportspersons, revealing mixed outcomes. While no significant changes were observed in pulse rate post-intervention, the consistency of pulse rates across participants improved slightly. However, yoga had a notable impact on oxygen saturation, with a significant increase in mean oxygen levels and reduced variability after the intervention. These findings suggest that while yoga may not directly influence pulse rate, it can significantly enhance respiratory function, highlighting its potential value in improving physiological health in athletes. Incorporating yoga into sports training could therefore improve oxygen utilization and respiratory efficiency.

Thus, comparing with few other Studies, the report of some authors like (Jerath et al., 2006) Pranayamic breathing triggers the activation of lung stretches receptors and stretches fibroblasts within connective tissue. This process enhances inhibitory neural signals and promotes hyperpolarization, which increases parasympathetic activity. As a result, blood pressure, heart rate, and oxygen consumption are reduced. According to (Gokhale et al., 2018) findings, pranayama intervention significantly increases blood oxygen saturation (SpO2). The improvement in oxygen saturation levels is likely due to enhanced blood circulation resulting from yoga practice. A study by (Taru & Kaluskar, 2022) found that practicing Yogasana enhances oxygen saturation, which facilitates optimal oxygen supply to the body's organs, ensuring proper functioning. The increase in blood oxygen levels improves circulation, promoting heartbeats, increased blood flow to muscles and lungs, and dilation of small blood vessels to enhance oxygen intake.

(Malhotra et al., 2021) observed a significant reduction in pulse rate after yoga, indicating a shift towards parasympathetic dominance. Though the decrease in oxygen saturation was minimal, several factors, such as stress index, energy resources, and neurohumoral regulation, improved significantly post-yoga. Yoga helps practitioners draw energy into the spine, renew reserves, and achieve relaxation by calming the heart, respiration, and circulation, leading to enhanced physical and mental calmness. (Pandya et al., 2020) noted that consistent yoga practice benefits cardiovascular health. By fostering a balanced lifestyle that includes exercise, healthy eating, and proper rest, yoga helps lower the risk of cardiovascular diseases through parasympathetic dominance, which enhances cardiovascular endurance. Therefore, a deep understanding of yogic practices can improve athletic performance and can lead toward better cardiovascular health and overall well-being in athletes.

Conclusion

This study demonstrates that regular yoga practice can have a positive effect on key physiological parameters in professional athletes. While no significant changes were observed in pulse rate, the improvement in oxygen saturation levels suggests enhanced respiratory efficiency and oxygen utilization. These findings align with previous research indicating that yoga can improve cardiovascular and respiratory health by promoting parasympathetic dominance, which supports recovery and endurance. Incorporating yoga into athletic training routines could therefore help athletes optimize their cardiovascular and respiratory functions, improving overall performance and reducing the risk of related health conditions.

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