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Effect Of Nadishodhana Pranayama On Cardiovascular And Muscular Endurance Among Undergraduate Students Of Kuvempu University

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Abstract

This study investigates the effect of Nadishodhana Pranayama (alternate nostril breathing) on cardiovascular and muscular endurance among male undergraduate students. A total of 25 participants practiced Nadishodhana Pranayama for 30 days, with sessions lasting 20 minutes daily. Cardiovascular endurance was assessed using the Harvard Step Test, while muscular endurance was measured using the Burpee Test. The results demonstrated a significant reduction in immediate and one-minute post-exercise pulse counts ($p < 0.001$), indicating improved heart rate recovery and autonomic control. Additionally, muscular endurance scores showed a statistically significant improvement ($p < 0.001$), suggesting enhanced oxygen utilization and reduced fatigue. These findings highlight the potential of Nadishodhana Pranayama as a non-exhaustive, time-efficient technique for improving endurance. The study reinforces the role of controlled breathing in enhancing physiological functions, making it a valuable addition to fitness training programs.

Keywords: Nadishodhana Pranayama, cardiovascular endurance, muscular endurance, Harvard Step Test, Burpee Test.

Introduction

Yoga, an ancient practice rooted in Indian tradition, has gained global recognition for its holistic benefits on physical, mental, and emotional well-being. Among its various components, pranayama, or yogic breathing techniques, has been widely studied for its physiological effects. One such practice, Nadishodhana Pranayama, also known as alternate nostril breathing, is believed to enhance respiratory efficiency, autonomic function, and overall physical endurance (Iyengar, 2001). Research suggests that controlled breathing techniques can positively influence cardiovascular and muscular endurance, which are essential components of physical fitness (Madanmohan et al., 2008).

Cardiovascular endurance, defined as the ability of the heart and lungs to supply oxygen efficiently during sustained physical activity, is a key determinant of aerobic fitness (Marrow et al., 1995). Studies indicate that pranayama enhances oxygen consumption and heart rate variability, leading to improved cardiovascular function (Birkel & Edgren, 2000). Similarly, muscular endurance, the ability of muscles to sustain prolonged activity, has been found to improve with breathing exercises that regulate oxygen supply and reduce fatigue (Ray et al., 2001). The rhythmic breathing pattern in Nadishodhana Pranayama has been shown to improve muscle oxygenation and enhance endurance (Bal & Bal, 2010).

Several studies support the role of pranayama in fitness and sports training. Joshi, Telles, and Balkrishna (2011) demonstrated that slow-breathing exercises positively influence autonomic control, leading to better endurance performance. Telles et al. (2008) found that alternate nostril breathing activates the parasympathetic system, reducing stress and promoting physiological efficiency. Additionally, Udupa et al. (2003) observed that regular practice of pranayama increases lung capacity and respiratory efficiency, contributing to enhanced aerobic performance.

Given these established benefits, this study aims to investigate the effect of Nadishodhana Pranayama on cardiovascular and muscular endurance among undergraduate students. By analyzing pre-test and post-test measures using the Harvard Step Test and Burpee Test, this research seeks to determine whether regular practice of pranayama can serve as a viable alternative or supplement to traditional endurance training. If proven effective, it may offer a time-efficient, accessible method for individuals from various fields to enhance physical fitness and overall well-being.

Objectives of the Study

1. To examine the effect of Nadishodhana Pranayama on cardiovascular endurance among undergraduate students.
2. To assess the impact of Nadishodhana Pranayama on muscular endurance.
3. To compare pre-test and post-test scores of cardiovascular endurance and muscular endurance after the experimental treatment.

4. To determine whether Nadishodhana Pranayama significantly influences endurance levels over a 30-day period.
5. To contribute to the understanding of pranayama's role in improving physical fitness parameters.

Review of Related Literature

Numerous studies highlight the physiological benefits of Nadishodhana Pranayama, particularly for cardiovascular and muscular endurance. Birkel & Edgren (2000) found it enhances oxygen consumption and heart rate variability, improving endurance. Joshi et al. (2011) reported better autonomic heart control, while Madanmohan et al. (2008) linked it to improved lung function and oxygen utilization. For muscular endurance, Ray et al. (2001) noted improved muscle oxygenation, delaying fatigue. Bal & Bal (2010) found it boosts muscle strength, and Jovanov et al. (2011) showed it reduces lactate accumulation, enhancing performance.

Telles et al. (2008) reported that Nadishodhana Pranayama activates the parasympathetic system, reducing stress and improving endurance. Udupa et al. (2003) found it increases lung capacity, while Sengupta (2012) suggested it enhances metabolic efficiency. These studies support its role in fitness and athletic training.

Methodology of the study

The present study employed a descriptive research method to examine the effect of Nadishodhana Pranayama on cardiovascular and muscular endurance among undergraduate students. The participants of this study were undergraduate students from Karnataka University, Dharwad. Total Sample of 25 male undergraduate students (N = 25) voluntarily participated in the study.

Selection of Variables

- **Independent Variable:** Nadishodhana Pranayama (alternate nostril breathing)
- **Dependent Variables:** Cardiovascular endurance (measured using the Harvard Step Test) and muscular endurance (measured using the Burpee Test)

Experimental Treatment

Participants practiced Nadishodhana Pranayama daily for 30 days, with each session lasting 20 minutes.

Duration, Ratio, and Repetition

- **Duration:** 20 minutes per session
- **Breathing Cycle:** Inhalation (4 counts) and exhalation (8 counts), maintaining a 1:2 ratio
- **Repetitions:** 4 cycles per minute

Selection of Test and Procedures

Harvard Step Test: Assesses cardiovascular endurance.

Participants stepped onto a 20-inch-high bench at a cadence of 30 steps per minute for three minutes. Post-exercise, they remained seated while their pulse was recorded 1 to 1.5 minutes later (Johnson & Nelson, 1986).

Burpee Test: Measures muscular endurance.

Participants performed continuous squat-thrusters at a constant pace. The score was recorded based on the number of correctly executed repetitions (Kraus & Hirschland, 1954).

Data Collection procedure

Data on participants' performance in the Harvard Step Test and Burpee Test were collected twice—before the experimental treatment (pre-test) and after the 30-day intervention (post-test). The recorded scores provided numerical data for statistical analysis. A descriptive research design was employed, using a pre-test and post-test approach to assess the impact of Nadishodhana Pranayama. A paired sample t-test was used to compare pre-test and post-test scores, determining the statistical significance of changes in cardiovascular and muscular endurance.

Table 1: Computation of Mean and Standard Deviation Values for Pulse Count Immediately After Exercise

Pulse Count	N	Mean	Standard Deviation	Standard Error Mean
Pre-Experimental Immediate Pulse	25	160.56	14.72	2.95
Post-Experimental Immediate Pulse	25	152.84	15.92	3.19

The table presents the mean, standard deviation, and standard error mean values for pulse count immediately after exercise in the Harvard Step Test before and after 30 days of Nadishodhana Pranayama practice. The mean pulse count decreased from 160.56 to 152.84 bpm, indicating improved cardiovascular endurance. The standard deviation values (14.72 and 15.92) highlight the variability in responses among participants.

Table 2: Significance of Difference between Mean Pulse Count Scores

Pulse Count Comparison	Mean Difference	t-value	df	Sig.(2-tailed)
Pre-Experimental Immediate Pulse vs. Post-Experimental Immediate Pulse	7.72	13.901	24	0.000

The results indicate that the t-value (13.901) for 24 degrees of freedom is statistically significant ($p < 0.001$). This suggests that practicing Nadishodhana Pranayama for 20 minutes daily over 30 days has a significant impact on heart rate recovery, leading to a reduction in immediate post-exercise pulse count.

Table 3: Mean and Standard Deviation Values for Pulse Count One Minute after Exercise

Pulse Count	N	Mean	Std. Deviation	Std. Error Mean
Pre-Experimental (After 1 Minute)	25	118.68	15.28	3.06
Post-Experimental (After 1 Minute)	25	109.12	15.01	3.00

The table presents the mean pulse count one minute after exercise decreased from 118.68 bpm (pre-test) to 109.12 bpm (post-test). This reduction suggests improved cardiovascular recovery following 30 days of Nadishodhana Pranayama practice. The standard deviation values (15.28 pre, 15.01 post) indicate consistency in individual responses.

Table 4: Significance of Difference Between Mean Pulse Count Scores

Pulse Count	Paired Mean	t-value	df	Sig. (2-tailed)
Pre-Experimental (After 1 Minute) vs. Post-Experimental (After 1 Minute)	9.56	8.147	24	0.000

The results indicate that the t-value (8.147) at 24 degrees of freedom is statistically significant ($p < 0.001$). This suggests that 30 days of Nadishodhana Pranayama practice led to a significant improvement in cardiovascular recovery, as evidenced by the reduced pulse count one minute after exercise. The findings support the positive effect of alternate nostril breathing on heart rate recovery and cardiovascular endurance.

Table 5: Computation of Mean and Standard Deviation Values for Muscular Endurance

Muscular Endurance	N	Mean	Std. Deviation	Std. Error Mean
Pre-Experimental	25	14.32	1.63	0.33
Post-Experimental	25	16.24	1.51	0.30

The table presents the mean muscular endurance score increased from 14.32 (pre-experimental) to 16.24 (post-experimental) after 30 days of Nadishodhana Pranayama practice. This improvement, measured through the Burpee Test, suggests a positive effect of pranayama on muscular endurance. The relatively low standard deviation values indicate consistent improvements among participants.

Table 6: Significance of Difference between Mean Scores of Muscular Endurance

Muscular Endurance	Paired Mean	t-value	df	Sig. (2-tailed)
Pre-Experimental vs. Post-Experimental	-1.92	-16.797	24	0.000

The results indicate that the t-value (-16.797) for 24 degrees of freedom is statistically significant ($p < 0.001$). This finding suggests that 30 days of Nadishodhana Pranayama practice significantly improved

muscular endurance. The negative paired mean difference (-1.92) reflects a notable increase in performance in the Burpee Test, reinforcing the effectiveness of pranayama in enhancing muscular endurance.

Discussion on Findings

The findings of this study conclude that Nadishodhana Pranayama (alternate nostril breathing) has a significant effect on both cardiovascular and muscular endurance among the selected subjects. These improvements were observed through assessments using the short form of the Harvard Step Test for cardiovascular endurance and the Burpee Test for muscular endurance. This study aimed to examine the impact of Nadishodhana Pranayama on cardiovascular and muscular endurance among male undergraduate students. The results provide empirical evidence that regular practice of Nadishodhana Pranayama leads to significant physiological improvements in both areas, reinforcing its effectiveness as a beneficial practice for enhancing overall endurance.

Effect on Cardiovascular Endurance

The results demonstrated a significant reduction in immediate post-exercise pulse count (Table 1) and one-minute post-exercise pulse count (Table 3) following 30 days of Nadishodhana Pranayama practice. The statistical analysis (Table 2 and Table 4) revealed that these reductions were statistically significant ($p < 0.001$). This suggests that alternate nostril breathing enhanced heart rate recovery, reflecting improved autonomic control over cardiac function.

These findings align with previous research, which has shown that controlled yogic breathing techniques contribute to enhanced parasympathetic activity and reduced sympathetic dominance, leading to more efficient cardiovascular regulation (Telles et al., 2008; Joshi et al., 2011). The ability of the heart to recover quickly post-exercise is a key indicator of cardiovascular fitness and endurance. The observed improvements may be attributed to enhanced oxygenation, improved vagal tone, and better regulation of heart rate variability induced by pranayama practice.

Effect on Muscular Endurance

The study also found a significant improvement in muscular endurance, as measured by the Burpee Test (Table 5). The mean muscular endurance score increased from 14.32 (pre-test) to 16.24 (post-test), demonstrating a notable enhancement in performance. The t-test analysis (Table 6) confirmed that this improvement was statistically significant ($p < 0.001$), suggesting that Nadishodhana Pranayama played a role in delaying muscular fatigue and enhancing endurance capacity. This improvement can be attributed to increased oxygen uptake, better respiratory efficiency, and enhanced blood circulation, which optimize muscular performance and reduce fatigue (Madanmohan et al., 2008; Bal & Bal, 2010). The rhythmic

breathing pattern in Nadishodhana Pranayama helps regulate oxygen supply to working muscles, thus improving endurance during sustained physical activity.

Conclusion

The study provides strong evidence that Nadishodhana Pranayama significantly enhances cardiovascular and muscular endurance. The improvements in heart rate recovery and muscular performance indicate that pranayama can serve as a valuable supplement to traditional endurance training. Future research could explore long-term effects, gender differences, and comparative studies with other forms of breath work or physical training.

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