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# THE IMPACT OF YOGIC PRACTICES INVOLVING PRANAYAMA AND SURYANAMASKAR ON SELECTED PHYSIOLOGICAL AND PHYSICAL VARIABLES IN INTER-COLLEGIATE EVENTS FOR FEMALE ATHLETES

**Dr. S. Adhavan**

Director - Physical Education, Rajiv Gandhi Arts and Science College, Puducherry, India.

**ARTICLE DETAILS**

**Research Paper**

**Keywords:**

*Breath-Holding Time, Flexibility, Muscle Strength, Pranayama, Suryanamaskar, VO2 Max, Yoga*

**ABSTRACT**

This research aimed to explore the impact of yogic practices, involving pranayama and suryanamaskar, on selected physiological and physical variables in inter-collegiate events for female athletes. The study involved 45 female athletes, aged 18 to 25 years, who were randomly chosen from colleges affiliated with Pondicherry University. A pretest-posttest experimental design was employed, with participants randomly assigned into three groups of 15 individuals each. Group I practiced yoga techniques focused on pranayama, Group II engaged in suryanamaskar exercises, and Group III served as a control group with no specific training. Physical variables such as muscle strength and flexibility were assessed, along with physiological variables including VO2 Max and breath-holding capacity. The evaluations utilized standardized tests: the sit-lying test, the sit-and-reach test, Cooper's 12-minute run/walk test, and the nose clip method. Data collection occurred both before and after the eight-week intervention. Statistical analysis was conducted using analysis of covariance (ANCOVA), with

a significance level of 0.05. Results indicated that the experimental groups exhibited significant improvements in muscle strength, flexibility, VO2 Max, and breath-holding duration compared to the control group.

## Introduction

Yoga is an ancient practice designed to harmonize physical, mental, emotional, and spiritual aspects of human well-being. As a holistic science, yoga integrates the mind and body, aiming for purification and balance on all levels. Unlike targeted physical exercises, yoga works comprehensively on the entire body, addressing muscles and systems vital for sports and everyday activities. Far from conflicting with personal beliefs, yoga fosters a profound connection with oneself, the environment, and a deeper sense of existence.

Over the years, yoga has gained recognition not only for enhancing flexibility and muscle tone but also for promoting mindfulness, focused breathing, meditation, and self-awareness. As highlighted by **Satyananda** (2005), the interplay between mind and body is crucial; psychological issues can manifest as physical ailments and vice versa. The modern embrace of yoga, particularly in Western culture and medicine, underscores its multifaceted benefits.

Hatha yoga, often associated with physical postures, emphasizes musculoskeletal strength, endurance, balance, and coordination. However, the broader scope of yoga encompasses practices like pranayama and suryanamaskar, which target both physical and spiritual growth.

### Pranayama

Pranayama, a precise breathing technique, focuses on controlling breath to regulate energy flow (prana) within the body. This practice requires a stable posture (asana) and involves mastering inhalation, exhalation, and breath retention. Pranayama symbolizes the union of physical and spiritual energy, encompassing various forms of life force throughout the body. By refining thoracic movements such as vertical, horizontal, and circumferential expansion, pranayama enhances physical vitality, mental clarity, and spiritual balance.

### Suryanamaskar

Suryanamaskar, or sun salutation, is a series of 12 dynamic poses aimed at enhancing physical, mental, and spiritual well-being. This sequence combines stretching, forward bending, and backward

arching movements that lengthen the spine, promote relaxation, and strengthen the body's core. Suryanamaskar has long been a cornerstone of traditional Indian yoga, often performed with synchronized breathing and meditative focus. According to **Parag** and **Manjunath** (2012), this practice aligns body, mind, and consciousness, fostering resilience, self-awareness, and a sense of purpose.

**Study Purpose**

The main objective of this research was to examine the effects of yogic practices, specifically pranayama and suryanamaskar, on selected physical and physiological parameters in female athletes participating in intercollegiate competitions.

**Hypotheses**

**H1:** It was hypothesized that yogic practices, specifically pranayama and suryanamaskar, would result in significant improvements in physical variables among intercollegiate female athletes.

**H2:** It was hypothesized that the incorporation of yogic practices, particularly pranayama and suryanamaskar, would lead to significant enhancements in physiological variables among female athletes participating in intercollegiate competitions.

**Methodology**

This study aimed to evaluate the impact of yogic practices, specifically pranayama and suryanamaskar, on physical variables like muscle strength and flexibility, as well as physiological parameters including VO2 max and breath-holding duration, among female athletes competing in intercollegiate events.

**Selection of Subjects**

This study aimed to assess the impact of yoga exercises, specifically pranayama and suryanamaskar, on selected physical and physiological parameters in female athletes participating in intercollegiate competitions. To meet this objective, 45 female students aged between 18 and 25 years were randomly selected from different colleges affiliated with Pondicherry University, Puducherry.

**Selection of Variables**

For this study, the following variables were identified:

**Independent Variables**

1. Yogic exercises focusing on pranayama
2. Suryanamaskar

**Dependent Variables**

**Physical Variables**

- Muscle Strength
- Flexibility

**Physiological Variables**

- VO2 Max
- Breath-Hold Time

**Criterion Measures**

1. **Muscle Strength -** Assessed using the sit-ups test, with results recorded in seconds.
2. **Flexibility** - Measured using the sit-and-reach test, with outcomes reported in centimeters.
3. **VO2 Max**- Evaluated using Cooper's 12-minute run/walk test, with results reported in meters.
4. **Breath-Holding Capacity**- Measured with a nose clip and the duration were recorded in seconds.

**Experimental Design**

The study employed a randomized group design. A total of 45 participants were randomly selected and divided into three groups, each consisting of 15 participants.

- Experimental Group I: Focused on yoga exercises involving pranayama.
- Experimental Group II: Focused on the practice of suryanamaskar.
- Control Group (Group III): Continued their regular daily activities without engaging in any additional exercises.

The yoga interventions were conducted over duration of eight weeks, with sessions held five days a week. Each session lasted 40 minutes. Assessments were carried out for all groups both before and after the intervention period to measure changes in selected physical and physiological parameters. The focus was on identifying significant differences among the three groups as a result of the experimental treatments.

**Training Programme**

Over the eight-week experimental period, the training sessions were organized as follows:

- Group I: Engaged in yoga exercises focusing on pranayama.
- Group II: Practiced suryanamaskar.
- Control Group: Did not participate in any conditioning or additional exercises and continued with their regular daily routines.

**Session Details**

- Duration: 40 minutes per session.
- Timing: 6:00 a.m. to 7:00 a.m., Monday through Saturday (excluding Sundays).

The specific schedule of exercises for the experimental groups is outlined in the table below.

**Yogic Practices involving Pranayama**

| | Duration (Mins) | Repetition | Sets | Rest between Practices (Sec) | Rest between Sets (Mins) |
|---|---|---|---|---|---|
| Loosening Exercises | 4 | 3 | 2 | 3 - 6 | 3 – 5 |
| Salabasana | 3 | 3 | 2 | 3 - 6 | |
| Vajrasana | 3 | 3 | 3 | 3 - 6 | |
| Halasana | 3 | 3 | 3 | 3 - 6 | |
| Bhujangasana | 3 | 3 | 3 | 3 - 6 | |
| Saravangasana | 3 | 3 | 2 | 3 - 6 | |
| Dhanurasana | 3 | 3 | 2 | 3 - 6 | |
| Savasana (Relaxation ) | 6 | 1 | - | - | |
| Nadi Shodhona Pranayama | 4 | 3 | 1 | 3 - 6 | |
| Bharstika Pranayama | 4 | 3 | 1 | 3 - 6 | |
| Kapalapathai Pranayama | 4 | 3 | 1 | 3 - 6 | |

**Suryanamaskar Practices**

| 1 – 4 Week |
|---|

| **Prayer and Warm-up Exercises** | | 5 mins | **Cool down Exercises** | | | 5 mins |
|---|---|---|---|---|---|---|
| **Day** | Mon. | Tue. | Wed. | Thu. | Fri. | Sat. |
| **Repetitions** | 14 | 14 | 14 | 14 | 14 | 14 |
| **Total Time (Mins)** | 30 | 30 | 30 | 30 | 30 | 30 |
| **5 – 8 Week** | | | | | | |
| **Prayer and Warm-up Exercises** | | 5 mins | **Cool down Exercises** | | | 5 mins |
| **Day** | Mon. | Tue. | Wed. | Thu. | Fri. | Sat. |
| **Repetitions** | 16 | 16 | 16 | 16 | 16 | 16 |
| **Total Time (Mins)** | 30 | 30 | 30 | 30 | 30 | 30 |

**Statistical Techniques**

An Analysis of Covariance (ANCOVA) was performed to determine the significance of mean differences across the three groups. Upon identifying a significant F ratio, Scheffé's Post Hoc test was applied to examine the significance of the adjusted final group means for each pair. Statistical significance was established at the 0.05 level.

**Table 1**

**Analysis of Covariance on Pretest, Posttest, and Adjusted Posttest Means for Muscle Strength and Flexibility in Experimental and Control Groups**

| **Test** | **Exp. Group I** | **Exp. Group II** | **Control Group** | **Source of Variance** | **Sum of Squares** | **df** | **Mean Square** | **F - Value** |
|---|---|---|---|---|---|---|---|---|
| **Vo2 Max** | | | | | | | | |
| Pre Test | 22.48 | 21.96 | 21.48 | Between | 7.51 | 2 | 3.753 | 1.28 |
| | | | | Within | 122.91 | 42 | 2.93 | |
| Post Test | 26.79 | 24.97 | 21.37 | Between | 228.62 | 2 | 114.31 | **49.38*** |
| | | | | Within | 97.22 | 42 | 2.31 | |
| Adjusted Post Test | 26.48 | 24.98 | 21.67 | Between | 171.68 | 2 | 83.84 | **66.73*** |
| | | | | Within | 50.472 | 41 | 1.23 | |
| **Breath Hold Time** | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pre Test | 36.77 | 35.67 | 35.08 | Between | 21.86 | 2 | 10.928 | 1.61 |
| | | | | Within | 285.82 | 42 | 6.81 | |
| Post Test | 43.79 | 40.57 | 35.06 | Between | 585.64 | 2 | 292.82 | **34.42*** |
| | | | | Within | 357.28 | 42 | 8.51 | |
| Adjusted Post Test | 42.98 | 40.72 | 35.72 | Between | 388.68 | 2 | 194.34 | **58.33*** |
| | | | | Within | 136.599 | 41 | 3.33 | |

***Significant at the 0.05 level of confidence***

The critical F-values for significance at the 0.05 level of confidence were 3.22 (for df = 2 and 42) and 3.23 (for df = 2 and 41).

The data presented in Table 1 highlights the pretest mean values for muscle strength in the experimental and control groups, which were 20.07, 18.86, and 18.60, respectively. The F-ratio calculated for the pretest means was 1.17, falling below the critical value of 3.22 for 2 and 42 degrees of freedom at the 0.05 level of significance. This result suggests no significant difference in muscle strength between the experimental and control groups prior to training, indicating the successful random assignment of subjects across the groups.

For the post-test muscle strength scores, the mean values for the experimental and control groups were 25.20, 26.26, and 19.33, respectively. The computed F-ratio of 33.18 exceeded the critical value of 3.22 at the 0.05 significance level, signifying a statistically significant difference in muscle strength between the groups after the training program.

The adjusted post-test mean values for muscle strength were 24.52, 26.50, and 19.77 for the experimental and control groups, respectively. The calculated F-ratio of 98.91 surpassed the required critical value of 3.23 for 2 and 41 degrees of freedom at the 0.05 significance level. This outcome reflects a significant enhancement in muscle strength due to the experimental training intervention.

Regarding flexibility, the pretest mean values for the experimental and control groups were 3.05, 3.02, and 2.85, respectively. The F-ratio for the pretest means was 0.13, which was below the critical value of 3.22 at the 0.05 significance level. This indicates no significant difference in flexibility between the groups before the intervention, confirming that the participant selection process was effective.

For the post-test flexibility scores, the experimental groups had mean values of 5.27 and 4.48, while the control group mean was 2.84. The F-ratio of 10.22 exceeded the critical value of 3.22, demonstrating a statistically significant improvement in flexibility among the experimental groups compared to the control group following the training program.

The adjusted post-test flexibility means were 5.19 and 4.43 for the experimental groups, while the control group mean was 2.98. The computed F-ratio of 34.27 was greater than the critical value of 3.23 for 2 and 41 degrees of freedom, confirming a significant improvement in flexibility as a result of the experimental training regimen.

**Table 2**

**Scheffé's Test for Pair wise Mean Differences in Physical Variables**

| Variables | Exp. Group I | Exp. Group II | Control Group | Mean Differences | Confidence Interval Value |
|---|---|---|---|---|---|
| **Muscle Strength** | 24.52 | 26.50 | - | 1.98 | 1.22 |
| | 24.52 | - | 19.77 | 4.75 | |
| | - | 26.50 | 19.77 | 6.73 | |
| **Flexibility** | 5.19 | 4.43 | - | 0.76 | 0.67 |
| | 5.19 | - | 2.98 | 2.21 | |
| | - | 4.43 | 2.98 | 1.45 | |

***Significant at the 0.05 level of confidence***

Table 2 shows that for muscle strength, the mean differences between experimental group I (yoga practices involving pranayama) and experimental group II (Suryanamaskar), between experimental group I and the control group, and between experimental group II and the control group are 1.98, 4.75, and 6.73, respectively. Each of these values exceeds the required confidence interval of 1.22, indicating statistical significance.

These findings reveal a significant variation in muscle strength across the groups: experimental group I compared to experimental group II, experimental group I compared to the control group, and experimental group II compared to the control group.

For flexibility, the mean differences between experimental group I (yoga practices with pranayama) and experimental group II (Suryanamaskar), between experimental group I and the control group, and between experimental group II and the control group are 0.76, 2.21, and 1.45, respectively. All these values surpass the confidence interval threshold of 0.67, confirming statistical significance.

The results emphasize significant differences in flexibility among the groups: experimental group I compared to experimental group II, experimental group I compared to the control group, and experimental group II compared to the control group.

**Table 3**

**Analysis of Covariance on Pretest, Posttest, and Adjusted Posttest Means for VO2 Max and Breath-Hold Time Across Experimental and Control Groups**

| Test | Exp. Group I | Exp. Group II | Control Group | Source of Variance | Sum of Squares | df | Mean Square | F - Value |
|---|---|---|---|---|---|---|---|---|
| **Vo2 Max** | | | | | | | | |
| Pre Test | 22.48 | 21.96 | 21.48 | Between | 7.51 | 2 | 3.753 | 1.28 |
| | | | | Within | 122.91 | 42 | 2.93 | |
| Post Test | 26.79 | 24.97 | 21.37 | Between | 228.62 | 2 | 114.31 | **49.38*** |
| | | | | Within | 97.22 | 42 | 2.31 | |
| Adjusted Post Test | 26.48 | 24.98 | 21.67 | Between | 171.68 | 2 | 83.84 | **66.73*** |
| | | | | Within | 50.472 | 41 | 1.23 | |
| **Breath Hold Time** | | | | | | | | |
| Pre Test | 36.77 | 35.67 | 35.08 | Between | 21.86 | 2 | 10.928 | 1.61 |
| | | | | Within | 285.82 | 42 | 6.81 | |
| Post Test | 43.79 | 40.57 | 35.06 | Between | 585.64 | 2 | 292.82 | **34.42*** |
| | | | | Within | 357.28 | 42 | 8.51 | |
| Adjusted Post Test | 42.98 | 40.72 | 35.72 | Between | 388.68 | 2 | 194.34 | **58.33*** |
| | | | | Within | 136.599 | 41 | 3.33 | |

***Significant at the 0.05 level of confidence***

The critical F-values for significance at the 0.05 level of confidence were 3.22 (for df = 2 and 42) and 3.23 (for df = 2 and 41).

The data in Table 3 shows that the pretest mean values of VO2 Max for the experimental groups were 22.48 and 21.96, while the control group recorded a mean of 21.48. The calculated F-ratio for these pretest means was 1.28, which is below the critical value of 3.22 for 2 and 42 degrees of freedom at the

0.05 level of significance. This indicates no significant differences in VO2 Max among the groups prior to the training intervention, affirming the suitability of the subject selection process.

Post-test VO2 Max mean values were 26.79 and 24.97 for the experimental groups, compared to 21.37 for the control group. The F-ratio of 49.38 exceeded the critical value of 3.22, indicating a statistically significant difference in VO2 Max between the groups following the intervention.

The adjusted post-test mean values for VO2 Max were 26.48, 24.98, and 21.67 for the two experimental groups and the control group, respectively. The calculated F-ratio for these adjusted means was 66.73, which surpasses the critical value of 3.23 for 2 and 41 degrees of freedom at the 0.05 significance level. This confirms a significant improvement in VO2 Max resulting from the experimental training.

For breath-hold time, the pretest mean values were 36.77 and 35.67 for the experimental groups, while the control group averaged 35.08. The calculated F-ratio of 1.61 was lower than the critical value of 3.22, indicating no significant difference in breath-hold time among the groups before the training began. This demonstrates that the initial allocation of participants to the groups was effective.

Post-test mean scores for breath-hold time were 43.79 and 40.57 for the experimental groups, and 35.06 for the control group. The calculated F-ratio of 34.42 exceeded the critical value of 3.22, highlighting a statistically significant improvement in breath-hold time for the experimental groups compared to the control group after training.

The adjusted post-test mean values for breath-hold time were 42.98 and 40.72 for the experimental groups, while the control group averaged 35.72. The calculated F-ratio for the adjusted means was 58.33, exceeding the critical value of 3.23 for 2 and 41 degrees of freedom at the 0.05 level of significance. This finding indicates a significant enhancement in breath-hold time attributable to the experimental training programs.

**Table 4**

**Scheffé's Test for Pair wise Mean Differences in Physiological Variables**

| Variables | Exp. Group I | Exp. Group II | Control Group | Mean Differences | Confidence Interval Value |
|---|---|---|---|---|---|
| **VO2 Max** | 26.48 | 24.98 | - | 1.50 | 1.01 |
| | 26.48 | - | 21.67 | 3.31 | |

| | | | | | |
|---|---|---|---|---|---|
| | - | 24.98 | 21.67 | 4.81 | |
| **Breath Hold Time** | 42.98 | 40.72 | - | 2.26 | 1.66 |
| | 42.98 | - | 35.72 | 7.26 | |
| | - | 40.72 | 35.72 | 5.00 | |

***Significant at the 0.05 level of confidence***

Table 4 presents the pair wise mean differences for VO2 Max across the groups. The differences between experimental group I (yogic practices involving pranayama) and experimental group II (Suryanamaskar), experimental group I and the control group, and experimental group II and the control group were 1.50, 3.31, and 4.81, respectively. All these values exceed the required confidence interval threshold of 1.01, confirming statistical significance.

These results indicate a significant variation in VO2 Max among the groups, with meaningful differences observed between experimental group I and experimental group II, experimental group I and the control group, and experimental group II compared to the control group.

For breath-hold time, the mean differences between experimental group I and experimental group II, experimental group I and the control group, and experimental group II and the control group were 2.26, 7.26, and 5.00, respectively. Each of these values surpasses the confidence interval requirement of 1.66, confirming their significance.

These findings further underscore a significant improvement in breath-hold time across the groups, with distinct differences identified between experimental group I and experimental group II, experimental group I and the control group, and experimental group II relative to the control group.

## Conclusion

1. Yogic practices incorporating pranayama have been shown to be significantly more effective than both the Suryanamaskar group and the control group in enhancing certain physical attributes, such as flexibility, and physiological measures, including VO2 Max and breath-hold time, among inter-collegiate athletes.
2. Suryanamaskar practice has demonstrated greater effectiveness compared to both yogic practices involving pranayama and the control group in improving specific physical variables, particularly muscle strength, among inter-collegiate athletes.

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