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Physiological Adaptations to Pranayama Practice in Teenage Female Volleyball Players

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ABSTRACT

The purpose of this study was to examine the influence of Pranayama on selected physiological parameters among female volleyball players aged 13–19 years. The participants were randomly assigned to two groups: an Experimental Group and a Control Group. A total of 84 female athletes participated in the study, with 42 subjects in each group. The Experimental Group completed a structured 16-week Pranayama training programme, whereas the Control Group did not undergo any form of Pranayama training during the study period. Pulmonary function was assessed by measuring Forced Expiratory Volume in one second (FEV_1) and Forced Vital Capacity (FVC) before and after the intervention. The collected data were analysed using the t-test, and the findings demonstrated statistically significant improvements in both FEV_1 and FVC among the participants who received Pranayama training.

Keywords: Pranayama, Forced expiratory volume, Forced Vital Capacity.

INTRODUCTION

In recent years, there has been an increasing interest in incorporating traditional wellness practices into modern athletic training regimens. One such practice is Pranayama, an ancient yogic technique centered on breath control through specific exercises and methods. Pranayama, which translates to "control of breath," is thought to enhance respiratory function, improve mental clarity, and bolster overall physiological health **(Saraswati, 2012).** This practice involves various breathing techniques designed to optimize oxygen intake and utilization, which can be especially advantageous for athletes striving for peak performance.

Competitive sports, particularly team sports like volleyball, demand intense physical exertion that can strain the respiratory system. For teenage female athletes participating in these high-intensity sports, maintaining optimal lung function and respiratory efficiency is vital for performance and recovery (**Smith & Jones, 2010**).

Forced Expiratory Volume in one second (FEV1) and Forced Vital Capacity (FVC) are key parameters used to assess lung function. FEV1 measures the volume of air exhaled forcefully in one second, reflecting airway patency and expulsion capability. FVC measures the total volume of air exhaled after a full inhalation, indicating overall lung capacity (**BTS, 2012**).

The rigorous nature of volleyball, where athletes experience bursts of high-intensity activity followed by recovery periods, effective respiratory function is crucial. Improvements in FEV1 and FVC could lead to enhanced endurance, quicker recovery, and better overall athletic performance (**Williams et al., 2015).**

This study aims to examine the impact of Pranayama on these crucial physiological parameters among teenage female volleyball players. By integrating a structured Pranayama training program into their routines, the research seeks to determine whether this breathing technique can positively affect FEV1 and FVC values. The findings could provide valuable insights into the effectiveness of Pranayama as a complementary training tool and its potential benefits for respiratory health and athletic performance.

Exploring the effects of Pranayama on respiratory parameters not only holds significance for athletic performance but also contributes to the broader understanding of how ancient practices can be adapted and utilized in modern sports science (**Ghosh, 2017**). This study will employ a rigorous evaluation of FEV1 and FVC changes before and after the Pranayama intervention, using a controlled experimental design to ensure reliable results. The outcomes may offer practical recommendations for incorporating Pranayama into training programs to enhance respiratory function and performance in competitive sports.

METHODOLOGY

2.1 Study Design:

This study utilized a randomized controlled trial design to investigate the effects of Pranayama on selected physiological parameters, specifically Forced Expiratory Volume in one second (FEV1) and Forced Vital Capacity (FVC), in teenage, female volleyball athletes aged 13 to 19 years.

2.2 Participants:

- **Sample Size and Selection:** A total of 84 female athletes from school level volleyball teams from J&K were recruited for this study. Participants were selected based on their age (13 to 19 years), physical health, and willingness to participate in the study. They were randomly assigned to either the Experimental Group or the Control Group.

- **Groups:**

Experimental Group (n=42): Participants in this group underwent a 16-week Pranayama training program.
Control Group (n=42): Participants in this group did not receive any Pranayama training and continued with their regular training routines.

2.3 Intervention:

- **Pranayama Training Program:** The Experimental Group engaged in a structured Pranayama program that included specific breathing exercises such as Anulom Vilom (alternate nostril breathing), Bhramari (bee breath), and Kapalabhati (skull shining breath). The training was conducted for 60 minutes per day, 5 days a week, over a period of 16 weeks. Sessions were supervised by a certified yoga instructor to ensure proper technique and adherence to the training protocol.

2.4 Measurements:

- **Pre-Intervention Assessment:** Both FEV1 and FVC were measured before the commencement of the Pranayama training. These measurements were taken using a spirometer to ensure accuracy and consistency.
- **Post-Intervention Assessment:** FEV1 and FVC were re-measured at the end of the 16-week training program. Measurements were taken under similar conditions as the pre-intervention assessments to ensure comparability.

2.5 Statistical Analysis:

Data collected from the spirometric measurements (FEV1 and FVC) were analyzed using statistical software. A paired t-test was conducted to compare the pre- and post-intervention values within the Experimental Group and the Control Group separately. An independent t-test was used to compare the changes in FEV1 and FVC between the Experimental and Control Groups. Statistical significance was set at $p<0.05$.

3. Data Analysis

Table 1: Mean, SD of Forced Expiratory Volume in one second (litres) and Comparison of t-test Between Pre and Post-test Means of female volleyball teenage athletes groups

Group	Pre-Test Mean	Post-Test Means	Pre-Test Standard Deviation	Pre-Test Standard Deviation	Mean Differences	T-Value
Experimental	2.04	2.53	0.22	0.31	0.49	20.28**
Control	2.01	1.96	0.11	0.11	0.05	0.69

at 0.01 level of Significance

Table 1 presents the finding of the study comparing ForcedExpiratory Volume(FEV1) measurements between the experimental and control groups, detailing both the pre-test and post-test results: The first experimental group exhibited a notable increase in FEV from a mean of 2.04 to 2.53. The mean difference of 0.49, combined with a t-value of 20.28, indicates a highly significant improvement ($p < 0.01$). This result suggests that the intervention used in this experimental group was highly effective in enhancing FEV1. The control group showed a slight decrease in FEV1 from 2.01 to 1.96. The mean difference of 0.05 and a t-value of 0.69 indicate that this change is not statistically significant ($p > 0.05$). This result suggests that there was no meaningful impact from the control conditions on FVC.

Fig 1: Graphs Representation of Forced Expiratory Volume in one second Between Pre and Post-test Means of female volleyball teenage athletes groups

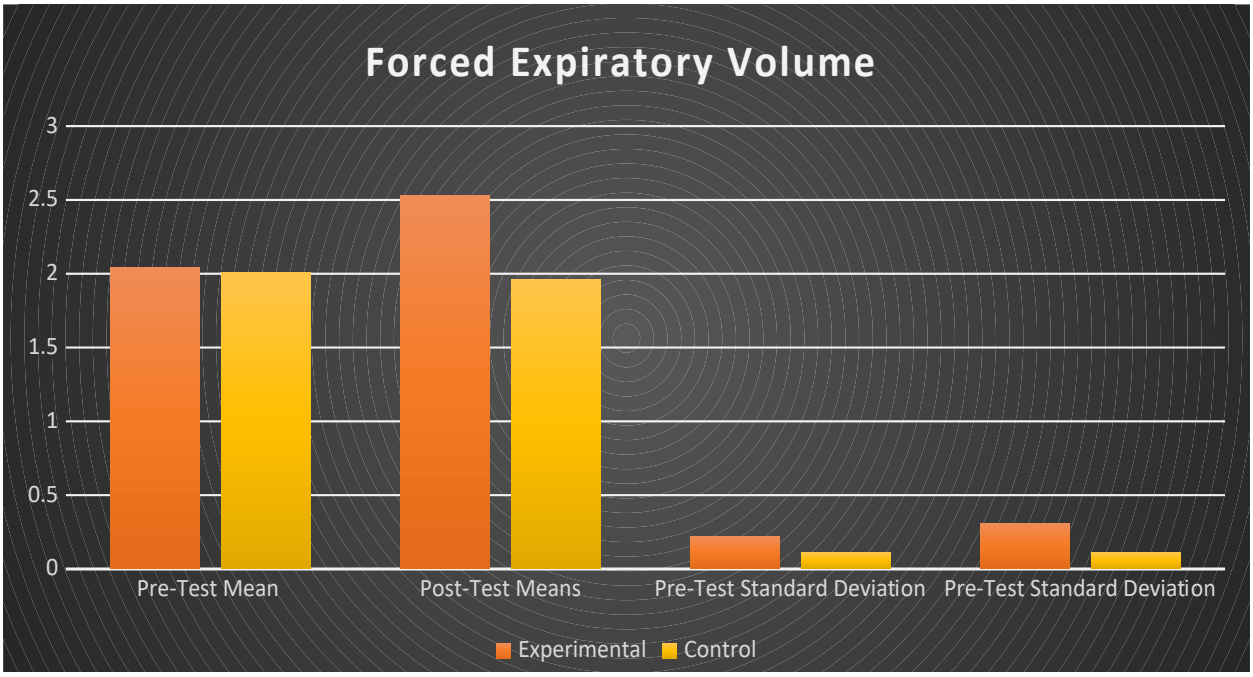


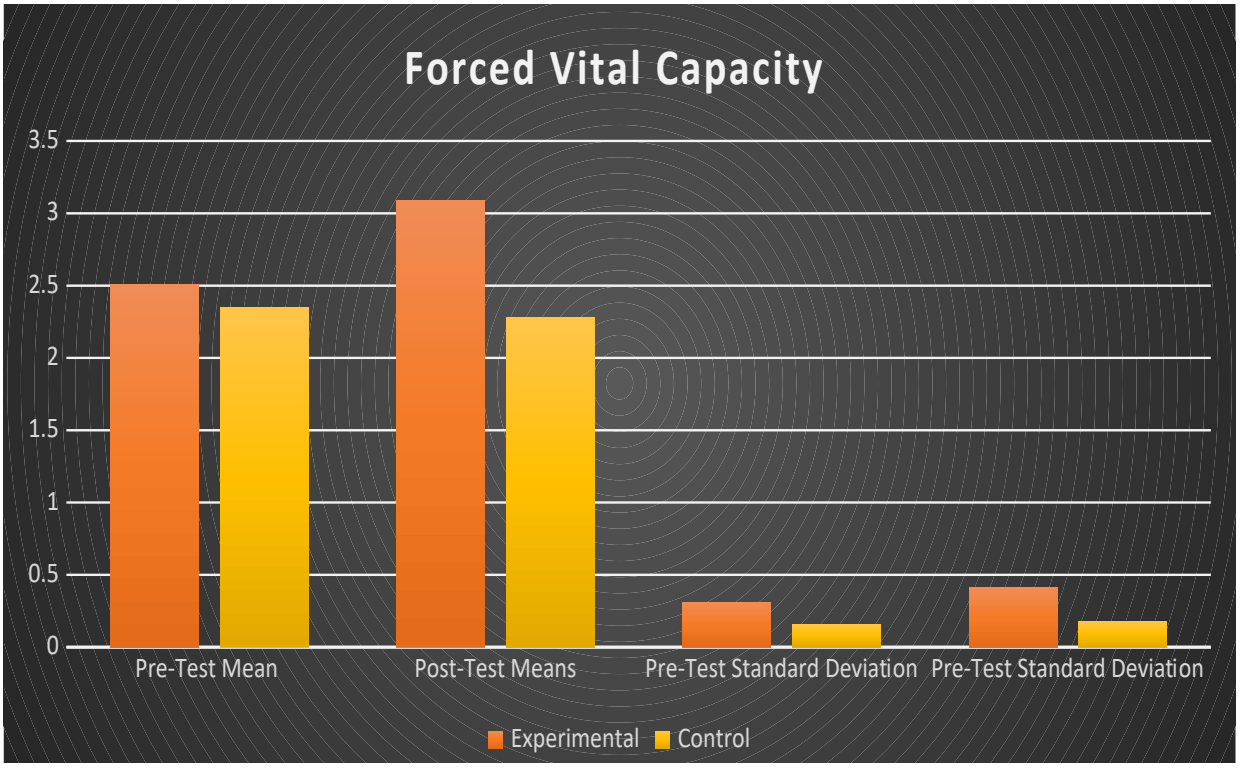
Table 2: Mean, SD of Forced Vital Capacity (litres) and Comparison between Pre and Post-test Means of female volleyball teenage athletes Groups by t-test

Group	Pre-Test Mean	Post-Test Means	Pre-Test Standard Deviation	Pre-Test Standard Deviation	Mean Differences	T-Value
Experimental	2.51	3.09	0.31	0.41	0.58	20.80**
Control	2.35	2.28	0.16	0.18	0.07	0.39

at 0.05 level of Significance

Table 2 presents the findings from the study, comparing the Forced Vital Capacity (FVC) measurements between experimental and control groups. The experimental group exhibited a significant increase in FVC from 2.51 to 3.09. The mean difference of 0.58 was accompanied by a t-value of 20.80, which is highly significant ($p < 0.01$). This suggests that the intervention had a substantial positive effect on improving FVC in this group. In contrast, the control group showed a slight decrease in FVC from 2.35 to 2.28. The mean difference of 0.07 and a t-value of 0.39 indicate that this change is not statistically significant ($p > 0.05$). This suggests no meaningful impact of the conditions applied to the control group.

Fig 2: Graphs Representation of Forced Vital Capacity between Pre and Post-test means of female volleyball teenage athletes Groups



RESULT AND CONCLUSION

Based on the results of this study and within its limitations, the following conclusions can be drawn:

1. **FEV1 Improvement:** There was a significant increase in FEV1 among the experimental groups following a sixteen-week Pranayama training program. The magnitude of this improvement was greater in the experimental groups compared to the control groups, where no significant change was observed.
2. **FVC Increase:** The Pranayama training also led to a significant increase in FVC in the experimental groups. Again, the magnitude of this increase was more pronounced in the experimental groups, while no significant change was found in the control groups.

Overall, the Pranayama training program had a positive impact on both FEV1 and FVC, with more substantial improvements observed in the experimental groups.

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